ACT/015/019 #2

PACIFICORP
ELECTRIC OPERATIONS

HYDRAULIC ANALYSIS AND DESIGN RELATED TO PERMIT CHANGES ORDERED BY THE UTAH DIVISION OF OIL, GAS, AND MINING FOR SEDIMENT PONDS AT THE COTTONWOOD/WILBERG MINE PORTAL

SEPTEMBER, 1991
Revised May, 1992

CONSULTANTS/ENGINEERS
HANSEN ALLEN & LUCE inc
SALT LAKE CITY, UTAH

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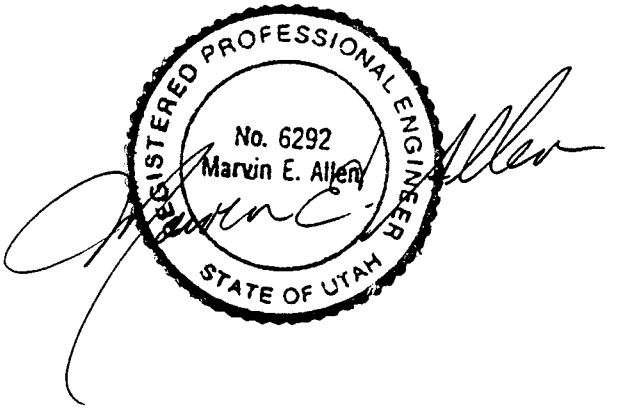
prepared for

PACIFICORP ELECTRICAL OPERATIONS GROUP



September, 1991
Revised May, 1992

by

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HANSEN ALLEN & LUCE INC

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INTRODUCTION

Six permit changes to sediment ponds at the PacifiCorp Cottonwood\Wilberg Mine portal were ordered by the Utah Division of Oil, Gas, and Mining (DOGM) based on a review of the sediment pond design conducted on June 3, 1991. These six permit changes are as follows:

1. Both ponds will meet all the sizing and monitoring requirements spelled out under MSHA, 30 CFR 77.216(a) and will have a principal and emergency spillway that in combination will safely pass a 100-year, 6-hour precipitation event per the requirements of R614-301-742.222.

2. The as-built drawings only show the outlet works and do not show the actual pond contours. An as-built drawing of both ponds showing as-built contours must be supplied with contours using two foot intervals. Elevations for sediment levels, storm volumes, and peak flows will be shown.

3. Pond #1 and #2 - A stage discharge curve is referenced on page 8 of Appendix XIII in the PAP but was not found. This information must be supplied along with calculations which include dewatering scenarios to verify detention time based on revised MSHA sizing criteria.

4. All decant elevations will adhere to State Health's criteria of at least two feet above the 60 percent sediment clean-out level and 18 inches above maximum sediment level. All decant elevations are currently set at the 60 percent clean-out level as shown on Plate 7704-C125 and 7704-C126. This is not acceptable.

5. The applicant will provide proof that the ponds provide adequate detention time to allow the discharge to meet Utah and Federal effluent limitations.

6. Neither pond has an oil-skimmer on their emergency spillway and these must be installed.

Hansen, Allen & Luce, Inc. (HA&L) was retained by PacifiCorp to provide the information and hydraulic design to assist PacifiCorp in responding to these six permit changes. Design details were to be provided in sufficient detail to present the hydraulic design criteria required to meet the applicable permit changes.

A hydrologic analysis associated with these sediment ponds was previously conducted by HA&L, the results of which were presented in a report entitled "Hydrologic Analysis of Undisturbed and Disturbed Area Runoff Control Ditches, Culverts, Sediment Ponds, and Sediment Basins at the Cottonwood\Wilberg Mine Portal Site and the Cottonwood Canyon Fan Portal Site," (June, 1989). This report is considered to be an update to the June 1989 report, and will supplement and update information presented in the earlier report. Information that has not changed, such as predicted sediment yield and the runoff volume (from the 10-year, 24-hour precipitation event) to the sediment ponds, will be extracted from the earlier report and incorporated herein without providing duplicate calculations.

HYDROLOGIC METHODOLOGY

This section outlines the methods used to estimate peak storm runoff flow rates and the stage discharge characteristics of the principal and emergency spillways.

FLOW HYDROGRAPHS AND PEAK DISCHARGE

The MSHA regulations require that the combined principal and emergency spillways for the sediment ponds be designed such as to pass at least the 100-year 6-hour storm event. The US Army Corps of Engineers' (COE) computer program "HEC-1 Flood Hydrograph Package" (COE, 1985) was used to model the 100-year, 6-hour design storm event to produce inflow and outflow hydrographs for the two sediment ponds at the Cottonwood/Wilberg Mine portal. The model was prepared using the SCS Curve Number and dimensionless unit hydrograph technique (SCS, 1972) to compute hydrographs for each sub-basin and the kinematic wave routing routine (COE, 1985) to route hydrographs to places of confluence. A detailed description of tributary sub-basins, sub-basin characteristics, and design related input and assumptions associated with the HEC-1 model is provided in the June, 1989 report and will not be presented again herein. The SCS 6-hour storm distribution was used in the analysis (SCS Tech. Release No. 60, revised 1985).

Values of precipitation (P) were selected for the designated design return periods from Volume VI-Utah of the NOAA Atlas 2 Precipitation-Frequency Atlas of the Western United States, (Miller et. al., 1973). Based on this publication, the 100-year, 6-hour precipitation depth is 2.3 inches and the 10-year, 24-hour precipitation depth is 2.4 inches.

STAGE DISCHARGE CURVES FOR PRINCIPAL AND EMERGENCY SPILLWAYS

The stage-discharge relationship of the corrugated metal risers and conduits used in the pond spillway design was determined from methods outlined by Barfield et. al. (1985), who state that the discharge of the spillway is calculated as the smallest of the possible flows due to weir flow, orifice flow, or pipe flow at any stage. The coefficients suggested by Barfield et. al. (1985) were used in the appropriate equations.

Weir flow is determined by the equation

$$q = CLH^{3/2} \tag{1}$$

where:

q	=	flow rate in cfs;
C	=	coefficient determined by entrance conditions;
L	=	length of the weir crest, in feet, or the circumference of the riser; in feet; and
H	=	head of water above the riser inlet, in feet.

The entrance coefficient (C) is determined by

$$C = 3.27 + 0.4H/W \tag{2}$$

where C and H are previously defined and W is the height of the weir crest above the channel bottom, in feet.

Orifice flow occurs when the flow is restricted by the opening. It can be determined as:

$$q = CA\ (2gH)^{1/2} \tag{3}$$

where:

q	=	as previously defined;
C	=	coefficient dependent upon the orifice geometry (0.6 in this case);
A	=	cross-sectional area of the opening, in square feet;
g	=	gravitational constant (32.2 ft/s^2); and
H	=	head above the orifice inlet, in feet.

The orifices considered are the riser inlet and the inlet of the conduit leading from the riser through the pond embankment.

Pipe flow occurs when the friction of the pipe controls the flow. According to Barfield et. al. (1985), this flow type can be described by:

$$q = \frac{A(2gH)^{1/2}}{(1 + K_e + K_b + K_c L)^{1/2}} \tag{4}$$

where q, A, g, and H are as previously defined and:

K_e	=	entrance loss coefficient (0.5 in this case);
K_b	=	correction factor for energy loss in bends (0.0 in this case);
K_c	=	friction factor; and
L	=	pipe length, in feet.

K_c can be determined by the equation

$$K_c = \frac{5087\,n^2}{d^{4/3}} \tag{5}$$

where:

n	=	Manning's roughness coefficient; and
d	=	inside diameter of the pipe, in inches.

The stage-discharge relationship of the open channel emergency spillway to be designed for Pond #2 (the south pond) was determined assuming the entrance to the channel to be a broad crested weir and by using the weir equation presented above. The coefficient C for the weir equation was determined from data presented by Brater and King (1976).

PERMIT CHANGES 1, 2, 3, AND 5

According to permit changes 1, 2, 3, and 5, the sediment ponds at the Cottonwood\Wilberg Mine portal are to be designed to have both principal and emergency spillways with a combined capacity to pass the peak runoff flow rate from the 100-year, 6-hour precipitation event. As-built drawings showing the plan view of the ponds with 2-foot contours are to be prepared, with elevations for sediment levels, storm volumes, and peak flows to be shown. Stage discharge curves were to be prepared and submitted for the principal and emergency spillways, and PacifiCorp was to provide proof that the ponds provide adequate detention time to allow the discharge to meet Utah and Federal effluent limitations.

PRINCIPAL AND EMERGENCY SPILLWAYS

Both the north and south ponds currently have principal spillways that consist of a 36-inch diameter corrugated metal pipe riser and outfall line. The ponds function in series with discharge from the northern pond flowing into the southern pond. Discharge from the southern pond principal spillway flows into a 90-inch diameter undisturbed area by-pass culvert.

The emergency spillway for the northern pond will consist of an additional 36-inch diameter corrugated metal pipe riser and outfall line (see Drawings 1 and 2). Similar to the principal spillway, the emergency spillway will discharge into the northern end of the southern sediment pond. The crest to this emergency spillway will be placed approximately one foot above the crest of the principal spillway. The crest of the principal spillway is at elevation 7365 feet MSL, which will place the crest of the emergency spillway at elevation 7366 feet MSL. In order to accommodate the emergency spillway and still provide adequate freeboard, the crest of the north pond embankment will be raised an additional foot where necessary to provide a minimum elevation for the crest of the embankment of 7368 feet MSL.

The emergency spillway for the southern pond will consist of an open channel spillway, having a trapezoidal cross-sectional area, with 3 horizontal to 1 vertical side slopes, a bottom width of approximately 9 feet, and a channel slope of approximately 2.3%. The channel will be lined with rock riprap having a mean rock diameter (D_{50}) of six inches (see calculations in the Appendix). This emergency spillway will be located near the south-eastern corner of the south sediment pond, and will discharge onto the existing paved roadway which runs along the eastern side of the sediment ponds. The crest to this emergency spillway will be placed approximately one foot above the crest of the principal spillway. The crest of the principal spillway is at elevation 7335 feet MSL, which will place the crest of the emergency spillway at elevation 7336 feet MSL. In order to accommodate the emergency spillway and still provide adequate freeboard, the crest of the south pond embankment will be raised an additional foot where necessary to provide a minimum elevation for the crest of the embankment of 7338 feet MSL.

Stage discharge curves for the principal and emergency spillways were developed as described in the "Hydrology Methodology" section. Calculations are presented in the Appendix. The stage discharge curves for the principal and emergency spillways for the north sediment pond are presented in Figure 1. The stage discharge curves for the principal and emergency spillways for the south sediment pond are presented in Figure 2.

Illustrated on Drawing 1 is the required as-built of both ponds showing contours using two-foot contour intervals. The base drawing showing the two-foot contours of the ponds was prepared by PacifiCorp from as-built survey information. Elevations for the sediment clean level, the 10-year, 24-hour precipitation event storage volume, and the 100-year, 6-hour peak discharge stage are also illustrated on the drawing.

Stage-capacity curves for the ponds were developed from the as-built information provided on Drawing 1 by planimetering each two-foot contour interval and then using the average-end-area method for computing volume between contours. New stage-capacity curves were developed for comparison with stage capacity curves previously submitted in the June, 1989 report. These new stage-capacity curves are presented on Figures 3 and 4 for the north and south ponds, respectively. The stage-capacity curves presented in the June, 1989 report were prepared from stage-capacity data provided at that time by Utah Power & Light Company, based on information provided to them by Roberts and Shaefer. The stage-capacity curve for the north pond developed from the as-built contour data provided on Drawing 1 shows the north pond to be similar in capacity, but somewhat larger than indicated in the stage-capacity curve presented in the June, 1989 report. The stage-capacity curve for the south pond developed from the as-built contour data provided on Drawing 1 shows the south pond to be nearly identical in capacity to that indicated in the stage-capacity curve presented in the June, 1989 report. Calculations for the stage-capacity curves are presented in the Appendix.

Based on information provided in the June, 1989 report, the calculated mean annual sediment yield to both ponds is 0.81 acre-feet and the required combined volume from both ponds to contain the 10-year, 24-hour precipitation event is 3.1 acre-feet. The data presented on Figures 3 and 4 indicate that the available sediment storage volume in the north and south ponds is 0.73 acre-feet and 0.31 acre-feet, respectively, for a combined available sediment storage volume of 1.04 acre-feet. The data presented on Figures 3 and 4 also indicate that the available storm runoff storage volume in the north and south ponds is 1.67 acre-feet and 1.56 acre-feet, respectively, for a combined available storm runoff storage volume of 3.23 acre-feet.

Using the stage-discharge curves for the principal and emergency spillways and the stage-capacity curves for the ponds, the peak discharge into and out of the north and south sediment ponds from the 100-year, 6-hour precipitation event was modeled using the Army Corps of Engineers "HEC-1 Flood Hydrograph" model. The ponds were assumed to be full of water up to the elevation of the principal spillway in each pond at the beginning of the 100-year, 6-hour precipitation event. The inflow hydrographs into each pond were routed through the ponds taking advantage of the effects of pond storage above the elevation of the crest of the principal spillway to attenuate the peak discharge of the outflowing hydrograph from each pond. The input data and output data from the model are presented in the Appendix.

The peak flow rate into the north pond from the 100-year, 6-hour precipitation event is estimated to be 35 cfs and the peak outflow rate is estimated to be 33 cfs at a stage of 7366.0 feet

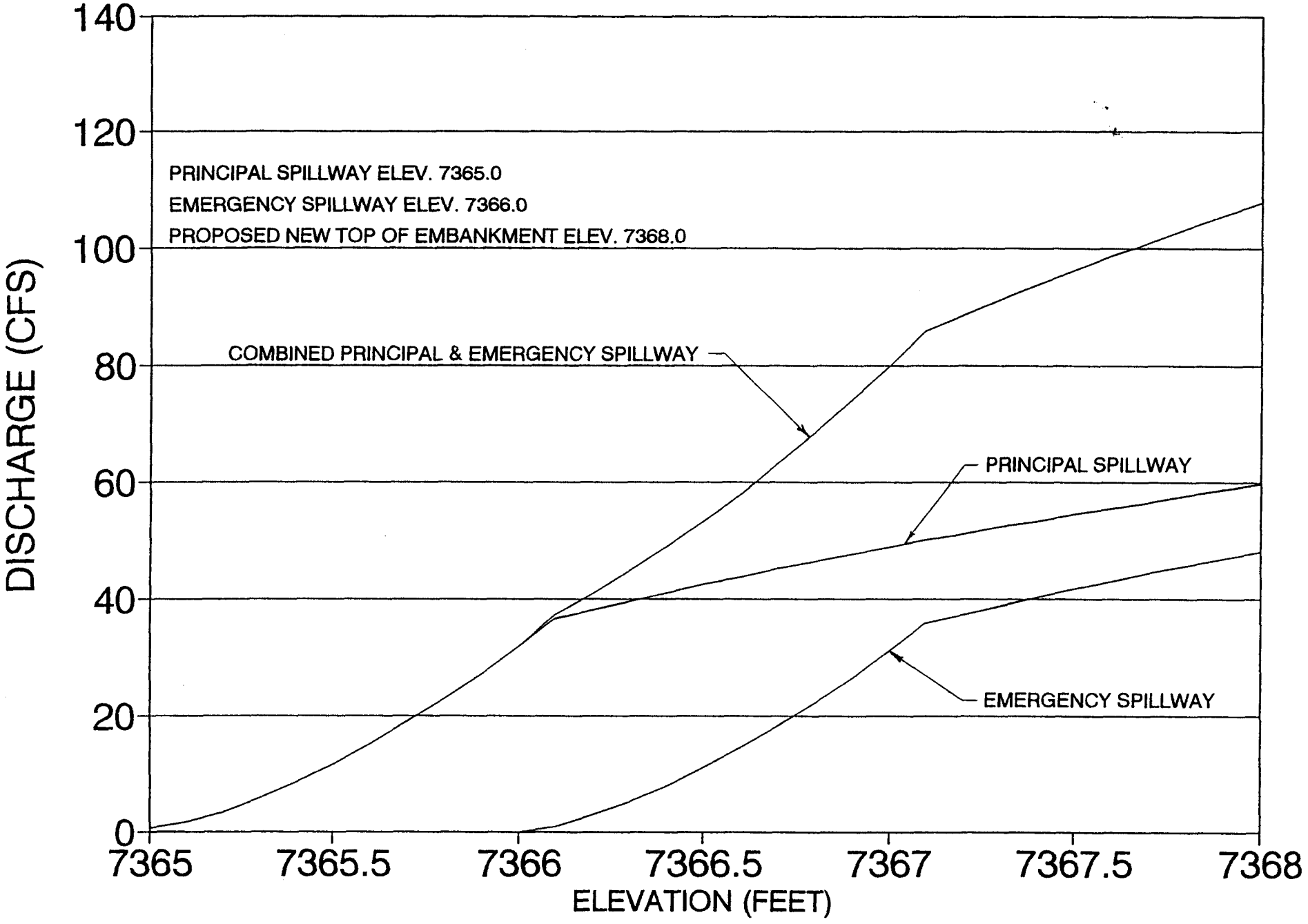

FIGURE 1

STAGE - DISCHARGE CURVE FOR NORTH SEDIMENT POND COTTONWOOD/WILBERG MINE PORTAL SITE 9/5/91

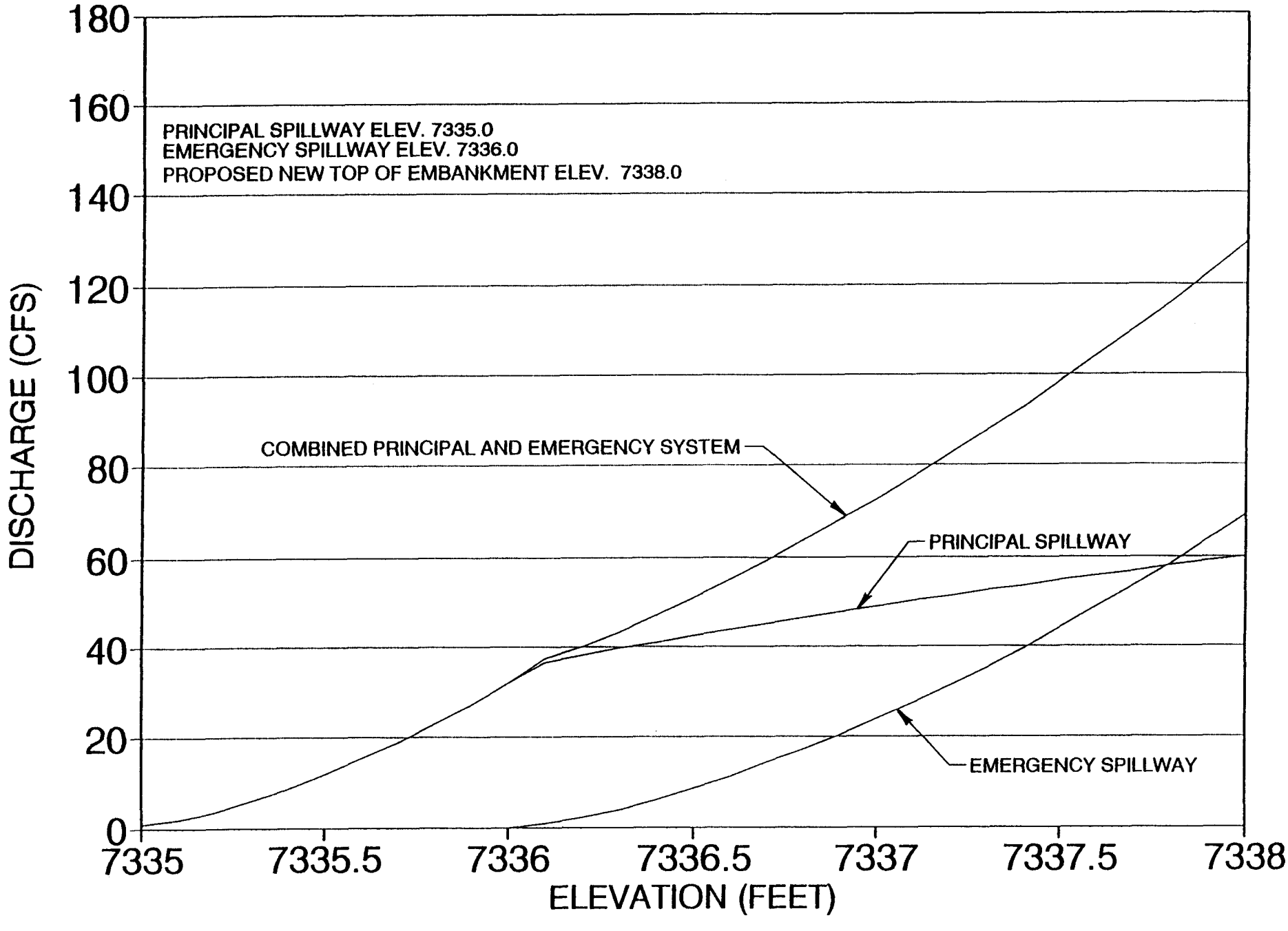

FIGURE 2

STAGE - DISCHARGE CURVE FOR SOUTH SEDIMENT POND COTTONWOOD/WILBERG MINE PORTAL SITE 9/5/91

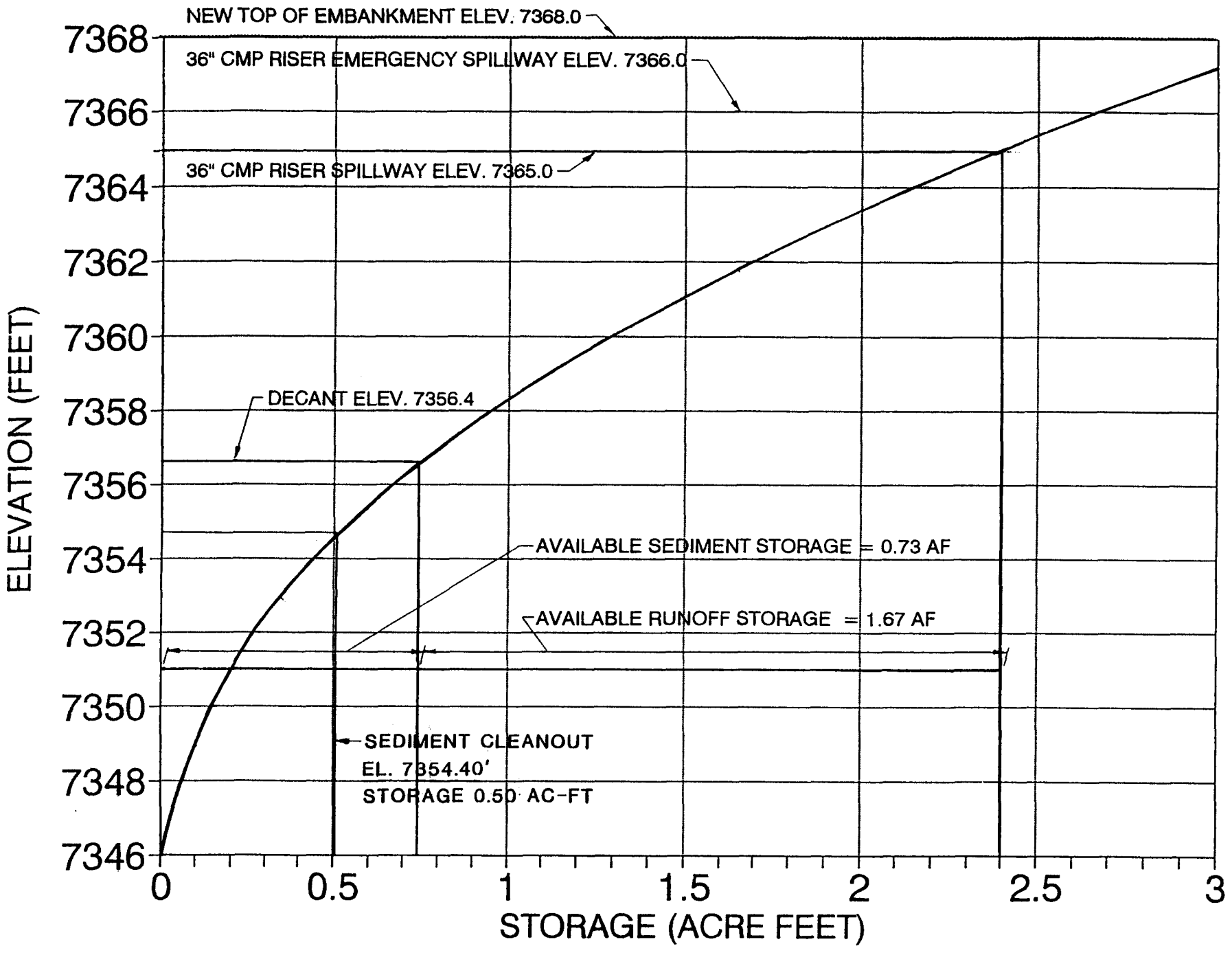

FIGURE 3

STAGE - CAPACITY CURVE FOR NORTH SEDIMENT POND COTTONWOOD/WILBERG MINE PORTAL SITE REVISED 9/5/91

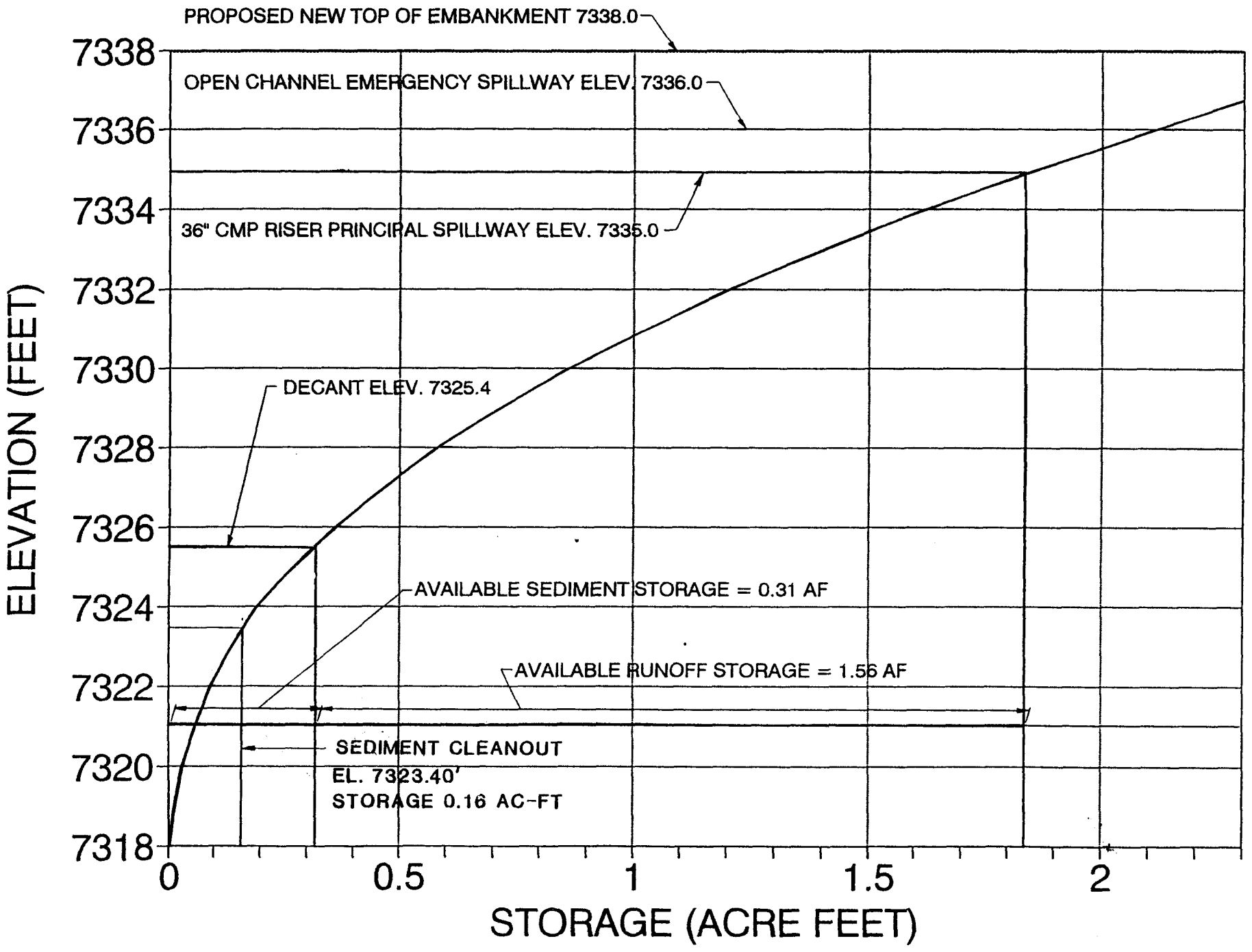

FIGURE 4

STAGE - CAPACITY CURVE FOR SOUTH SEDIMENT POND COTTONWOOD/WILBERG MINE PORTAL SITE REVISED 9/5/91

MSL (1.0 feet above the crest of the principal spillway). Since the crest of the emergency spillway is to be 1.0 foot above the crest of the principal spillway, the principal spillway alone has sufficient capacity to carry the peak discharge out of the pond from the 100-year, 6-hour precipitation event. Thus, the combined capacity of the principal and emergency spillways in the north pond is more than sufficient to handle the peak discharge from the 100-year, 6-hour precipitation event.

The peak flow rate into the south pond from the 100-year, 6-hour precipitation event is estimated to be 35 cfs and the peak outflow rate is estimated to be 33 cfs at a stage of 7336.0 feet MSL (0.95 feet above the crest of the principal spillway). Since the crest of the emergency spillway is to be 1.0 foot above the crest of the principal spillway, the south pond principal spillway alone has sufficient capacity to carry the peak discharge out of the pond from the 100-year, 6-hour precipitation event. Thus, the combined capacity of the principal and emergency spillways in the south pond is more than sufficient to handle the peak discharge from the 100-year, 6-hour precipitation event.

POND DETENTION TIME

A 3-inch diameter orifice has been constructed in the side of the principal spillway in each pond to serve as the decant for dewatering the ponds after a run-off producing precipitation event of a magnitude less than or equal to the 10-year, 24-hour precipitation event. The bottom of the decant in the north pond is at elevation 7356.4 feet MSL and the bottom of the decant in the south pond is at elevation 7325.4 feet MSL. The detention time for water once it enters the ponds must be sufficient to allow the suspended sediments in the runoff water to settle prior to the water exiting the ponds in order to meet effluent standards for the ponds. The general standard for this detention time is 24 hours between the centroid of the inflowing hydrograph into the pond and the centroid of the outflowing hydrograph from the pond. Since the north and south sediment ponds function in series, this detention time applies between the centroid of the inflowing hydrograph into the north pond and the centroid of the outflowing hydrograph from the south pond.

Using the stage-capacity curves for the ponds, the stage-discharge curves for the spillways, and stage-discharge data for the decants set at the elevations indicated above, the inflow hydrographs from a 10-year, 24-hour precipitation event were generated, routed through the ponds, and a resulting outflow hydrograph generated using the Army Corps of Engineers "HEC-1 Flood Hydrograph" model. The ponds were assumed to be full of water up to the elevation of the bottom of the decant in each pond at the beginning of the 10-year, 24-hour precipitation event. The input data and output data from the model are presented in the Appendix. The detention time between the centroid of the inflow hydrograph into the north pond and the centroid of the outflow hydrograph out of the south pond is estimated to be 28 hours. Thus, the detention time should be adequate.

PERMIT CHANGE 4

According to permit change 4, the decant elevations will adhere to the State Health's criteria of at least two feet above the 60% sediment clean-out level and 18 inches above the maximum sediment level. Permit change 4 also indicates that "all decant elevations are currently set at the 60 percent clean-out level."

Based on discussions with David R. Ariotti, District Engineer with the State of Utah Department of Environmental Quality - Southeast Utah District (DEQ), the State Health's criteria for the decant elevations pertains only to a height above the sediment clean-out level and not to a height above the maximum sediment level. Mr. Ariotti indicated at a meeting held at his office on September 9, 1991 that DEQ's preference is to have this height be a minimum of 2 feet, but that they are willing to accept it at 18 inches.

The elevation of the sediment clean-out level for each pond is illustrated in the stage-capacity curves for the north and south ponds on Figures 3 and 4, respectively. The elevation for the sediment clean-out level in the north pond is 7354.4 feet MSL, which is 2 feet below the decant elevation in the north pond. The elevation for the sediment clean-out level in the south pond is 7323.4 feet MSL, which is 2 feet below the decant elevation in the south pond.

PERMIT CHANGE 6

According to permit change 4, "neither pond has an oil-skimmer on their emergency spillway and these must be installed."

Currently, the ponds only have principal spillways. An oil-skimmer is to be installed on the top of the standpipes of the principal spillways as illustrated on Drawing 2. An oil-skimmer will also be installed on the top of the standpipe of the emergency spillway of the north pond.

REFERENCES

Barfield, B.J., R.C. Warner, and C.T. Haan. 1985. Applied Hydrology and Sedimentology For Disturbed Areas. Oklahoma Technical Press, 815 Hillcrest, Stillwater, Oklahoma.

Brater, Ernest F., and Horace Williams King. 1976. Handbook of Hydraulics for the Solution of Hydraulic Engineering Problems. McGraw-Hill Book Company. New York, New York.

Hansen, Allen & Luce, Inc. June 1989. Hydrologic Analysis of Undisturbed and Disturbed Area Runoff Control Ditches, Culverts, Sediment Ponds, and Sediment Basins at the Cottonwood/Wilberg Mine Portal Site and the Cottonwood Canyon Fan Portal Site. Prepared for Utah Power & Light Co., Salt Lake City, Utah.

Miller, J.F., R.H. Frederick, and R.J. Tracey, 1973. NOAA Atlas 2 - Precipitation-Frequency Atlas of the Western, United States, Volume VI-Utah. U.S. National Oceanic and Atmospheric Administration. U.S. Government Printing Office. Washington, D.C.

U.S. Army Corps of Engineers (C.O.E.). 1985. "HEC-1 Flood Hydrograph Hydrologic Engineering Center, 609 Second Street, David, California.

U.S. Soil conservation Service. 1985. Earth Dams and Reservoirs. Technical Release No. 60. U.S. Government Printing Office. Washington, D.C.

Wright-McLaughlin Engineers (WME). 1969 (6th printing 1978, revised 1984). "Urban Storm Drainage Criteria Manual." Denver Regional Council of Governments, Denver, Colorado.

APPENDIX

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APPENDIX

Stage-Discharge Calculations - Principal and Emergency Spillways

Stage-Capacity Calculations - North and South Ponds

HEC-1 Model Output - 100-year, 6-hour Precipitation Event

Detention Time Calculations Between the Inflow Hydrograph Into the North Pond and the Outflow Hydrograph from the South Pond - 10-year, 24-hour Precipitation Event

South Pond Emergency Spillway Riprap Design Calculations

Anti-Seep Collar Design Calculations

Stage-Discharge Calculations
Principal and Emergency Spillways

Hansen, Allen, & Luce Inc.
UP&L Cottonwood/Wilburg Mine Sediment Ponds
Stage - Discharge, North Pond

JAH
06-Sep-91

Weir Control

Q=CLH^(3/2)
C=3.27+0.4(H/W)
W (FT.) 20
W for ES 21
W = depth of water from bottom of reservoir to top of spillway
ES = Emergency Spillway
Q = Flow (cfs)

Orifice Control

Q=C'a(2GH)^(1/2)
C'= 0.60
C'a 4.24

Pipe Control

Q=a(2GH')^(1/2)/((1+Ke+Kb+KcL)^(1/2))
h=(BEG. ELEV - END ELEV)-0.6(PIPE DIA.)
H'=H+h

DISCHARGE ELEV.	7345.00
Ke	1.00
Kb	0.50
Kc	0.0267
L (FT)	130.0
h	9.6
h for ES	19.2

a conservatively long culvert length was assumed, the culvert capacity was found to not limit spillway capacity for the available stages

Principal and Emergency Spillway Data

PIPE DIAMETER (IN)	36.00
AREA, a (FT^2)	7.07
LENGTH, L (FT.)	9.42
PRIMARY SPILLWAY ELEV.	7365.00
EMERGENCY SPILLWAY ELEV. (ES)	7366.00
DECANT ELEV.	7356.40

Decant Data

PIPE DIAMETER (IN)	3
AREA, a (FT^2)	0.05
2G^.5	8.02
C'a	0.03

		PRINCIPLE SPILLWAY												EMERGENCY SPILLWAY										
		3" DECANT LINE		WEIR DISCHARGE (CFS)			ORIFICE DISCHARGE			PIPE DISCHARGE		MAX DISCHARGE	WEIR DISCHARGE (CFS)			ORIFICE DISCHARGE			PIPE DISCHARGE		MAX DISCHARGE	COMBINED DISCHARGE
Stage	Elev	H	Q3o	H	C	Qw	H	Qo	Q	H'	Qp	Qmax	H	C	Qw	H	Qo	Q	H'	Qp	Qmax	Q(total)
0	7356.5	0	0.00	0.0	3.27	0.00	0.0	0.00	0.00	9.6	175.76	0.00	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.00
0.1	7356.6	0.1	0.07	0.0	3.27	0.00	0.0	0.00	0.07	9.7	176.67	0.07	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.07
0.2	7356.7	0.2	0.11	0.0	3.27	0.00	0.0	0.00	0.11	9.8	177.58	0.11	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.11
0.3	7356.8	0.3	0.13	0.0	3.27	0.00	0.0	0.00	0.13	9.9	178.48	0.13	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.13
0.4	7356.9	0.4	0.15	0.0	3.27	0.00	0.0	0.00	0.15	10.0	179.38	0.15	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.15
0.5	7357.0	0.5	0.17	0.0	3.27	0.00	0.0	0.00	0.17	10.1	180.28	0.17	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.17
0.6	7357.1	0.6	0.18	0.0	3.27	0.00	0.0	0.00	0.18	10.2	181.17	0.18	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.18
0.7	7357.2	0.7	0.20	0.0	3.27	0.00	0.0	0.00	0.20	10.3	182.05	0.20	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.20
0.8	7357.3	0.8	0.21	0.0	3.27	0.00	0.0	0.00	0.21	10.4	182.93	0.21	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.21
0.9	7357.4	0.9	0.22	0.0	3.27	0.00	0.0	0.00	0.22	10.5	183.81	0.22	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.22
1.0	7357.5	1.0	0.24	0.0	3.27	0.00	0.0	0.00	0.24	10.6	184.68	0.24	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.24
1.1	7357.6	1.1	0.25	0.0	3.27	0.00	0.0	0.00	0.25	10.7	185.55	0.25	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.25
1.2	7357.7	1.2	0.26	0.0	3.27	0.00	0.0	0.00	0.26	10.8	186.42	0.26	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.26
1.3	7357.8	1.3	0.27	0.0	3.27	0.00	0.0	0.00	0.27	10.9	187.28	0.27	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.27
1.4	7357.9	1.4	0.28	0.0	3.27	0.00	0.0	0.00	0.28	11.0	188.14	0.28	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.28
1.5	7358.0	1.5	0.29	0.0	3.27	0.00	0.0	0.00	0.29	11.1	188.99	0.29	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.29
1.6	7358.1	1.6	0.30	0.0	3.27	0.00	0.0	0.00	0.30	11.2	189.84	0.30	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.30
1.7	7358.2	1.7	0.31	0.0	3.27	0.00	0.0	0.00	0.31	11.3	190.68	0.31	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.31
1.8	7358.3	1.8	0.32	0.0	3.27	0.00	0.0	0.00	0.32	11.4	191.53	0.32	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.32
1.9	7358.4	1.9	0.33	0.0	3.27	0.00	0.0	0.00	0.33	11.5	192.36	0.33	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.33
2.0	7358.5	2.0	0.33	0.0	3.27	0.00	0.0	0.00	0.33	11.6	193.20	0.33	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.33
2.1	7358.6	2.1	0.34	0.0	3.27	0.00	0.0	0.00	0.34	11.7	194.03	0.34	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.34
2.2	7358.7	2.2	0.35	0.0	3.27	0.00	0.0	0.00	0.35	11.8	194.86	0.35	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.35
2.3	7358.8	2.3	0.36	0.0	3.27	0.00	0.0	0.00	0.36	11.9	195.68	0.36	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.36
2.4	7358.9	2.4	0.37	0.0	3.27	0.00	0.0	0.00	0.37	12.0	196.50	0.37	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.37
2.5	7359.0	2.5	0.37	0.0	3.27	0.00	0.0	0.00	0.37	12.1	197.32	0.37	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.37

2.6	7359.1	2.6	0.38	0.0	3.27	0.00	0.0	0.00	0.38	12.2	198.13	0.38	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.38
2.7	7359.2	2.7	0.39	0.0	3.27	0.00	0.0	0.00	0.39	12.3	198.94	0.39	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.39
2.8	7359.3	2.8	0.40	0.0	3.27	0.00	0.0	0.00	0.40	12.4	199.75	0.40	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.40
2.9	7359.4	2.9	0.40	0.0	3.27	0.00	0.0	0.00	0.40	12.5	200.55	0.40	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.40
3.0	7359.5	3.0	0.41	0.0	3.27	0.00	0.0	0.00	0.41	12.6	201.35	0.41	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.41
3.1	7359.6	3.1	0.42	0.0	3.27	0.00	0.0	0.00	0.42	12.7	202.15	0.42	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.42
3.2	7359.7	3.2	0.42	0.0	3.27	0.00	0.0	0.00	0.42	12.8	202.95	0.42	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.42
3.3	7359.8	3.3	0.43	0.0	3.27	0.00	0.0	0.00	0.43	12.9	203.74	0.43	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.43
3.4	7359.9	3.4	0.44	0.0	3.27	0.00	0.0	0.00	0.44	13.0	204.53	0.44	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.44
3.5	7360.0	3.5	0.44	0.0	3.27	0.00	0.0	0.00	0.44	13.1	205.31	0.44	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.44
3.6	7360.1	3.6	0.45	0.0	3.27	0.00	0.0	0.00	0.45	13.2	206.09	0.45	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.45
3.7	7360.2	3.7	0.45	0.0	3.27	0.00	0.0	0.00	0.45	13.3	206.87	0.45	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.45
3.8	7360.3	3.8	0.46	0.0	3.27	0.00	0.0	0.00	0.46	13.4	207.65	0.46	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.46
3.9	7360.4	3.9	0.47	0.0	3.27	0.00	0.0	0.00	0.47	13.5	208.42	0.47	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.47
4.0	7360.5	4.0	0.47	0.0	3.27	0.00	0.0	0.00	0.47	13.6	209.19	0.47	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.47
4.1	7360.6	4.1	0.48	0.0	3.27	0.00	0.0	0.00	0.48	13.7	209.96	0.48	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.48
4.2	7360.7	4.2	0.48	0.0	3.27	0.00	0.0	0.00	0.48	13.8	210.72	0.48	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.48
4.3	7360.8	4.3	0.49	0.0	3.27	0.00	0.0	0.00	0.49	13.9	211.49	0.49	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.49
4.4	7360.9	4.4	0.50	0.0	3.27	0.00	0.0	0.00	0.50	14.0	212.25	0.50	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.50
4.5	7361.0	4.5	0.50	0.0	3.27	0.00	0.0	0.00	0.50	14.1	213.00	0.50	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.50
4.6	7361.1	4.6	0.51	0.0	3.27	0.00	0.0	0.00	0.51	14.2	213.76	0.51	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.51
4.7	7361.2	4.7	0.51	0.0	3.27	0.00	0.0	0.00	0.51	14.3	214.51	0.51	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.51
4.8	7361.3	4.8	0.52	0.0	3.27	0.00	0.0	0.00	0.52	14.4	215.26	0.52	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.52
4.9	7361.4	4.9	0.52	0.0	3.27	0.00	0.0	0.00	0.52	14.5	216.00	0.52	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.52
5.0	7361.5	5.0	0.53	0.0	3.27	0.00	0.0	0.00	0.53	14.6	216.75	0.53	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.53
5.1	7361.6	5.1	0.53	0.0	3.27	0.00	0.0	0.00	0.53	14.7	217.49	0.53	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.53
5.2	7361.7	5.2	0.54	0.0	3.27	0.00	0.0	0.00	0.54	14.8	218.23	0.54	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.54
5.3	7361.8	5.3	0.54	0.0	3.27	0.00	0.0	0.00	0.54	14.9	218.96	0.54	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.54
5.4	7361.9	5.4	0.55	0.0	3.27	0.00	0.0	0.00	0.55	15.0	219.70	0.55	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.55
5.5	7362.0	5.5	0.55	0.0	3.27	0.00	0.0	0.00	0.55	15.1	220.43	0.55	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.55
5.6	7362.1	5.6	0.56	0.0	3.27	0.00	0.0	0.00	0.56	15.2	221.16	0.56	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.56
5.7	7362.2	5.7	0.56	0.0	3.27	0.00	0.0	0.00	0.56	15.3	221.88	0.56	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.56
5.8	7362.3	5.8	0.57	0.0	3.27	0.00	0.0	0.00	0.57	15.4	222.61	0.57	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.57
5.9	7362.4	5.9	0.57	0.0	3.27	0.00	0.0	0.00	0.57	15.5	223.33	0.57	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.57
6.0	7362.5	6.0	0.58	0.0	3.27	0.00	0.0	0.00	0.58	15.6	224.05	0.58	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.58
6.1	7362.6	6.1	0.58	0.0	3.27	0.00	0.0	0.00	0.58	15.7	224.76	0.58	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.58
6.2	7362.7	6.2	0.59	0.0	3.27	0.00	0.0	0.00	0.59	15.8	225.48	0.59	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.59
6.3	7362.8	6.3	0.59	0.0	3.27	0.00	0.0	0.00	0.59	15.9	226.19	0.59	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.59
6.4	7362.9	6.4	0.60	0.0	3.27	0.00	0.0	0.00	0.60	16.0	226.90	0.60	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.60
6.5	7363.0	6.5	0.60	0.0	3.27	0.00	0.0	0.00	0.60	16.1	227.61	0.60	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.60
6.6	7363.1	6.6	0.61	0.0	3.27	0.00	0.0	0.00	0.61	16.2	228.31	0.61	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.61
6.7	7363.2	6.7	0.61	0.0	3.27	0.00	0.0	0.00	0.61	16.3	229.02	0.61	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.61
6.8	7363.3	6.8	0.62	0.0	3.27	0.00	0.0	0.00	0.62	16.4	229.72	0.62	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.62
6.9	7363.4	6.9	0.62	0.0	3.27	0.00	0.0	0.00	0.62	16.5	230.42	0.62	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.62
7.0	7363.5	7.0	0.63	0.0	3.27	0.00	0.0	0.00	0.63	16.6	231.12	0.63	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.63
7.1	7363.6	7.1	0.63	0.0	3.27	0.00	0.0	0.00	0.63	16.7	231.81	0.63	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.63
7.2	7363.7	7.2	0.63	0.0	3.27	0.00	0.0	0.00	0.63	16.8	232.50	0.63	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.63
7.3	7363.8	7.3	0.64	0.0	3.27	0.00	0.0	0.00	0.64	16.9	233.19	0.64	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.64
7.4	7363.9	7.4	0.64	0.0	3.27	0.00	0.0	0.00	0.64	17.0	233.88	0.64	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.64
7.5	7364.0	7.5	0.65	0.0	3.27	0.00	0.0	0.00	0.65	17.1	234.57	0.65	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.65
7.6	7364.1	7.6	0.65	0.0	3.27	0.00	0.0	0.00	0.65	17.2	235.26	0.65	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.65
7.7	7364.2	7.7	0.66	0.0	3.27	0.00	0.0	0.00	0.66	17.3	235.94	0.66	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.66
7.8	7364.3	7.8	0.66	0.0	3.27	0.00	0.0	0.00	0.66	17.4	236.62	0.66	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.66
7.9	7364.4	7.9	0.66	0.0	3.27	0.00	0.0	0.00	0.66	17.5	237.30	0.66	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.66
8.0	7364.5	8.0	0.67	0.0	3.27	0.00	0.0	0.00	0.67	17.6	237.98	0.67	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.67
8.1	7364.6	8.1	0.67	0.0	3.27	0.00	0.0	0.00	0.67	17.7	238.65	0.67	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.67

8.2	7364.7	8.2	0.68	0.0	3.27	0.00	0.0	0.00	0.68	17.8	239.32	0.68	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.68
8.3	7364.8	8.3	0.68	0.0	3.27	0.00	0.0	0.00	0.68	17.9	239.99	0.68	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.68
8.4	7364.9	8.4	0.69	0.0	3.27	0.00	0.0	0.00	0.69	18.0	240.66	0.69	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.69
8.5	7365.0	8.5	0.69	0.0	3.27	0.00	0.0	0.00	0.69	18.1	241.33	0.69	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.69
8.6	7365.1	8.6	0.69	0.1	3.27	0.98	0.1	10.76	1.67	18.2	242.00	1.67	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	1.67
8.7	7365.2	8.7	0.70	0.2	3.27	2.76	0.2	15.22	3.46	18.3	242.66	3.46	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	3.46
8.8	7365.3	8.8	0.70	0.3	3.28	5.07	0.3	18.64	5.77	18.4	243.32	5.77	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	5.77
8.9	7365.4	8.9	0.71	0.4	3.28	7.82	0.4	21.53	8.52	18.5	243.98	8.52	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	8.52
9.0	7365.5	9.0	0.71	0.5	3.28	10.93	0.5	24.07	11.64	18.6	244.64	11.64	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	11.64
9.1	7365.6	9.1	0.71	0.6	3.28	14.38	0.6	26.36	15.09	18.7	245.30	15.09	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	15.09
9.2	7365.7	9.2	0.72	0.7	3.28	18.13	0.7	28.48	18.84	18.8	245.95	18.84	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	18.84
9.3	7365.8	9.3	0.72	0.8	3.29	22.16	0.8	30.44	22.88	18.9	246.61	22.88	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	22.88
9.4	7365.9	9.4	0.72	0.9	3.29	26.46	0.9	32.29	27.18	19.0	247.26	27.18	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	27.18
9.5	7366.0	9.5	0.73	1.0	3.29	31.01	1.0	34.04	31.74	19.1	247.91	31.74	0.0	3.27	0.00	0.0	0.00	0.00	0.0	0.00	0.00	31.74
9.6	7366.1	9.6	0.73	1.1	3.29	35.79	1.1	35.70	36.43	19.2	248.56	36.43	0.1	3.27	0.98	0.1	10.76	0.98	19.3	101.98	0.98	37.40
9.7	7366.2	9.7	0.74	1.2	3.29	40.81	1.2	37.28	38.02	19.3	249.20	38.02	0.2	3.27	2.76	0.2	15.22	2.76	19.4	102.25	2.76	40.78
9.8	7366.3	9.8	0.74	1.3	3.30	46.04	1.3	38.81	39.55	19.4	249.85	39.55	0.3	3.28	5.07	0.3	18.64	5.07	19.5	102.51	5.07	44.62
9.9	7366.4	9.9	0.74	1.4	3.30	51.49	1.4	40.27	41.01	19.5	250.49	41.01	0.4	3.28	7.81	0.4	21.53	7.81	19.6	102.77	7.81	48.83
10.0	7366.5	10.0	0.75	1.5	3.30	57.14	1.5	41.68	42.43	19.6	251.13	42.43	0.5	3.28	10.93	0.5	24.07	10.93	19.7	103.04	10.93	53.36
10.1	7366.6	10.1	0.75	1.6	3.30	62.98	1.6	43.05	43.80	19.7	251.77	43.80	0.6	3.28	14.37	0.6	26.36	14.37	19.8	103.30	14.37	58.18
10.2	7366.7	10.2	0.75	1.7	3.30	69.02	1.7	44.38	45.13	19.8	252.41	45.13	0.7	3.28	18.12	0.7	28.48	18.12	19.9	103.56	18.12	63.25
10.3	7366.8	10.3	0.76	1.8	3.31	75.25	1.8	45.66	46.42	19.9	253.05	46.42	0.8	3.29	22.16	0.8	30.44	22.16	20.0	103.82	22.16	68.58
10.4	7366.9	10.4	0.76	1.9	3.31	81.65	1.9	46.91	47.68	20.0	253.68	47.68	0.9	3.29	26.45	0.9	32.29	26.45	20.1	104.08	26.45	74.13
10.5	7367.0	10.5	0.77	2.0	3.31	88.24	2.0	48.13	48.90	20.1	254.32	48.90	1.0	3.29	31.00	1.0	34.04	31.00	20.2	104.33	31.00	79.90
10.6	7367.1	10.6	0.77	2.1	3.31	94.99	2.1	49.32	50.09	20.2	254.95	50.09	1.1	3.29	35.78	1.1	35.70	35.70	20.3	104.59	35.70	85.79
10.7	7367.2	10.7	0.77	2.2	3.31	101.92	2.2	50.48	51.26	20.3	255.58	51.26	1.2	3.29	40.80	1.2	37.28	37.28	20.4	104.85	37.28	88.54
10.8	7367.3	10.8	0.78	2.3	3.32	109.01	2.3	51.62	52.39	20.4	256.21	52.39	1.3	3.29	46.03	1.3	38.81	38.81	20.5	105.11	38.81	91.20
10.9	7367.4	10.9	0.78	2.4	3.32	116.27	2.4	52.73	53.51	20.5	256.83	53.51	1.4	3.30	51.47	1.4	40.27	40.27	20.6	105.36	40.27	93.78
11.0	7367.5	11.0	0.78	2.5	3.32	123.69	2.5	53.81	54.60	20.6	257.46	54.60	1.5	3.30	57.11	1.5	41.68	41.68	20.7	105.62	41.68	96.28
11.1	7367.6	11.1	0.79	2.6	3.32	131.26	2.6	54.88	55.67	20.7	258.08	55.67	1.6	3.30	62.95	1.6	43.05	43.05	20.8	105.87	43.05	98.72
11.2	7367.7	11.2	0.79	2.7	3.32	138.99	2.7	55.93	56.72	20.8	258.71	56.72	1.7	3.30	68.99	1.7	44.38	44.38	20.9	106.13	44.38	101.09
11.3	7367.8	11.3	0.79	2.8	3.33	146.87	2.8	56.95	57.75	20.9	259.33	57.75	1.8	3.30	75.21	1.8	45.66	45.66	21.0	106.38	45.66	103.41
11.4	7367.9	11.4	0.80	2.9	3.33	154.90	2.9	57.96	58.76	21.0	259.95	58.76	1.9	3.31	81.61	1.9	46.91	46.91	21.1	106.63	46.91	105.67
11.5	7368.0	11.5	0.80	3.0	3.33	163.08	3.0	58.95	59.75	21.1	260.57	59.75	2.0	3.31	88.18	2.0	48.13	48.13	21.2	106.89	48.13	107.88
11.6	7368.1	11.6	0.80	3.1	3.33	171.40	3.1	59.92	60.73	21.2	261.18	60.73	2.1	3.31	94.94	2.1	49.32	49.32	21.3	107.14	49.32	110.05
11.7	7368.2	11.7	0.81	3.2	3.33	179.87	3.2	60.88	61.69	21.3	261.80	61.69	2.2	3.31	101.86	2.2	50.48	50.48	21.4	107.39	50.48	112.17
11.8	7368.3	11.8	0.81	3.3	3.34	188.48	3.3	61.83	62.64	21.4	262.41	62.64	2.3	3.31	108.94	2.3	51.62	51.62	21.5	107.64	51.62	114.26
11.9	7368.4	11.9	0.82	3.4	3.34	197.23	3.4	62.76	63.57	21.5	263.02	63.57	2.4	3.32	116.19	2.4	52.73	52.73	21.6	107.89	52.73	116.30
12.0	7368.5	12.0	0.82	3.5	3.34	206.12	3.5	63.67	64.49	21.6	263.63	64.49	2.5	3.32	123.60	2.5	53.81	53.81	21.7	108.14	53.81	118.31
12.1	7368.6	12.1	0.82	3.6	3.34	215.15	3.6	64.58	65.40	21.7	264.24	65.40	2.6	3.32	131.16	2.6	54.88	54.88	21.8	108.39	54.88	120.28
12.2	7368.7	12.2	0.83	3.7	3.34	224.31	3.7	65.47	66.29	21.8	264.85	66.29	2.7	3.32	138.88	2.7	55.93	55.93	21.9	108.64	55.93	122.22
12.3	7368.8	12.3	0.83	3.8	3.35	233.60	3.8	66.35	67.18	21.9	265.46	67.18	2.8	3.32	146.75	2.8	56.95	56.95	22.0	108.88	56.95	124.13
12.4	7368.9	12.4	0.83	3.9	3.35	243.03	3.9	67.21	68.05	22.0	266.06	68.05	2.9	3.33	154.77	2.9	57.96	57.96	22.1	109.13	57.96	126.01
12.5	7369.0	12.5	0.84	4.0	3.35	252.58	4.0	68.07	68.91	22.1	266.67	68.91	3.0	3.33	162.94	3.0	58.95	58.95	22.2	109.38	58.95	127.86
12.6	7369.1	12.6	0.84	4.1	3.35	262.27	4.1	68.92	69.75	22.2	267.27	69.75	3.1	3.33	171.25	3.1	59.92	59.92	22.3	109.62	59.92	129.68
12.7	7369.2	12.7	0.84	4.2	3.35	272.09	4.2	69.75	70.59	22.3	267.87	70.59	3.2	3.33	179.71	3.2	60.88	60.88	22.4	109.87	60.88	131.48
12.8	7369.3	12.8	0.85	4.3	3.36	282.03	4.3	70.58	71.42	22.4	268.47	71.42	3.3	3.33	188.30	3.3	61.83	61.83	22.5	110.11	61.83	133.25
12.9	7369.4	12.9	0.85	4.4	3.36	292.10	4.4	71.39	72.24	22.5	269.07	72.24	3.4	3.33	197.04	3.4	62.76	62.76	22.6	110.36	62.76	135.00
13.0	7369.5	13.0	0.85	4.5	3.36	302.29	4.5	72.20	73.05	22.6	269.67	73.05	3.5	3.34	205.91	3.5	63.67	63.67	22.7	110.60	63.67	136.73

Hansen, Allen, & Luce Inc.
UP&L Cottonwood/Wilburg Mine Sediment Ponds
Stage - Discharge, South Pond

JAH
06-Sep-91

Weir Control
Q=CLH^(3/2)
C=3.27+0.4(H/W)
W (FT.) = 20
W = depth of water to top of the spillway

Orifice Control
Q=C'a(2GH)^(1/2)

C'=	0.60
C'a	4.24

Pipe Control
Q=a(2GH')^(1/2)/((1+Ke+Kb+KcL)^(1/2))
h=(BEG. ELEV - END ELEV)-0.6(PIPE DIA.)
H'=H+h

Discharge Elev.	7313.50
Ke	1.00
Kb	0.50
Kc	0.0267
L (FT)	130.0
h	11.9

conservatively long culvert length assumed, culvert capacity was found to not limit spillway capacity

Princpal Spillway Data

PIPE DIAMETER (IN)	36.00
AREA, a (FT^2)	7.07
LENGTH, L (FT.)	9.42
PRIMARY SPILLWAY ELEV.	7335.00
EMERGENCY SPILLWAY ELEV. (ES)	7336.00
DECANT ELEV.	7325.40

Decant Data

PIPE DIAMETER (IN)	3
AREA, a (FT^2)	0.05
2G^.5	8.02
C'a	0.03

		PRINCIPLE SPILLWAY												EMERGENCY SPILLWAY			
		3" DECANT LINE		WEIR DISCHARGE (CFS)			ORIFICE DISCHARGE			PIPE DISCHARGE		MAX DISCHARGE	WEIR DISCHARGE (CFS)			COMBINED DISCHARGE
Stage	Elev	H	Q3o	H	C	Qw	H	Qo	Q	H'	Qp	Qmax	H	C	Qw	Q(total)
0	7325.4	0	0.00	0.0	3.27	0.00	0.0	0.00	0.00	11.9	195.68	0.00	0.0	0.00	0.00	0.00
0.1	7325.5	0.1	0.07	0.0	3.27	0.00	0.0	0.00	0.07	12.0	196.50	0.07	0.0	0.00	0.00	0.07
0.2	7325.6	0.2	0.11	0.0	3.27	0.00	0.0	0.00	0.11	12.1	197.32	0.11	0.0	0.00	0.00	0.11
0.3	7325.7	0.3	0.13	0.0	3.27	0.00	0.0	0.00	0.13	12.2	198.13	0.13	0.0	0.00	0.00	0.13
0.4	7325.8	0.4	0.15	0.0	3.27	0.00	0.0	0.00	0.15	12.3	198.94	0.15	0.0	0.00	0.00	0.15
0.5	7325.9	0.5	0.17	0.0	3.27	0.00	0.0	0.00	0.17	12.4	199.75	0.17	0.0	0.00	0.00	0.17
0.6	7326.0	0.6	0.18	0.0	3.27	0.00	0.0	0.00	0.18	12.5	200.55	0.18	0.0	0.00	0.00	0.18
0.7	7326.1	0.7	0.20	0.0	3.27	0.00	0.0	0.00	0.20	12.6	201.35	0.20	0.0	0.00	0.00	0.20
0.8	7326.2	0.8	0.21	0.0	3.27	0.00	0.0	0.00	0.21	12.7	202.15	0.21	0.0	0.00	0.00	0.21
0.9	7326.3	0.9	0.22	0.0	3.27	0.00	0.0	0.00	0.22	12.8	202.95	0.22	0.0	0.00	0.00	0.22
1.0	7326.4	1.0	0.24	0.0	3.27	0.00	0.0	0.00	0.24	12.9	203.74	0.24	0.0	0.00	0.00	0.24
1.1	7326.5	1.1	0.25	0.0	3.27	0.00	0.0	0.00	0.25	13.0	204.53	0.25	0.0	0.00	0.00	0.25
1.2	7326.6	1.2	0.26	0.0	3.27	0.00	0.0	0.00	0.26	13.1	205.31	0.26	0.0	0.00	0.00	0.26
1.3	7326.7	1.3	0.27	0.0	3.27	0.00	0.0	0.00	0.27	13.2	206.09	0.27	0.0	0.00	0.00	0.27
1.4	7326.8	1.4	0.28	0.0	3.27	0.00	0.0	0.00	0.28	13.3	206.87	0.28	0.0	0.00	0.00	0.28
1.5	7326.9	1.5	0.29	0.0	3.27	0.00	0.0	0.00	0.29	13.4	207.65	0.29	0.0	0.00	0.00	0.29
1.6	7327.0	1.6	0.30	0.0	3.27	0.00	0.0	0.00	0.30	13.5	208.42	0.30	0.0	0.00	0.00	0.30
1.7	7327.1	1.7	0.31	0.0	3.27	0.00	0.0	0.00	0.31	13.6	209.19	0.31	0.0	0.00	0.00	0.31
1.8	7327.2	1.8	0.32	0.0	3.27	0.00	0.0	0.00	0.32	13.7	209.96	0.32	0.0	0.00	0.00	0.32
1.9	7327.3	1.9	0.33	0.0	3.27	0.00	0.0	0.00	0.33	13.8	210.72	0.33	0.0	0.00	0.00	0.33
2.0	7327.4	2.0	0.33	0.0	3.27	0.00	0.0	0.00	0.33	13.9	211.49	0.33	0.0	0.00	0.00	0.33
2.1	7327.5	2.1	0.34	0.0	3.27	0.00	0.0	0.00	0.34	14.0	212.25	0.34	0.0	0.00	0.00	0.34
2.2	7327.6	2.2	0.35	0.0	3.27	0.00	0.0	0.00	0.35	14.1	213.00	0.35	0.0	0.00	0.00	0.35
2.3	7327.7	2.3	0.36	0.0	3.27	0.00	0.0	0.00	0.36	14.2	213.76	0.36	0.0	0.00	0.00	0.36
2.4	7327.8	2.4	0.37	0.0	3.27	0.00	0.0	0.00	0.37	14.3	214.51	0.37	0.0	0.00	0.00	0.37
2.5	7327.9	2.5	0.37	0.0	3.27	0.00	0.0	0.00	0.37	14.4	215.26	0.37	0.0	0.00	0.00	0.37

2.6	7328.0	2.6	0.38	0.0	3.27	0.00	0.0	0.00	0.38	14.5	216.00	0.38	0.0	0.00	0.00	0.38
2.7	7328.1	2.7	0.39	0.0	3.27	0.00	0.0	0.00	0.39	14.6	216.75	0.39	0.0	0.00	0.00	0.39
2.8	7328.2	2.8	0.40	0.0	3.27	0.00	0.0	0.00	0.40	14.7	217.49	0.40	0.0	0.00	0.00	0.40
2.9	7328.3	2.9	0.40	0.0	3.27	0.00	0.0	0.00	0.40	14.8	218.23	0.40	0.0	0.00	0.00	0.40
3.0	7328.4	3.0	0.41	0.0	3.27	0.00	0.0	0.00	0.41	14.9	218.96	0.41	0.0	0.00	0.00	0.41
3.1	7328.5	3.1	0.42	0.0	3.27	0.00	0.0	0.00	0.42	15.0	219.70	0.42	0.0	0.00	0.00	0.42
3.2	7328.6	3.2	0.42	0.0	3.27	0.00	0.0	0.00	0.42	15.1	220.43	0.42	0.0	0.00	0.00	0.42
3.3	7328.7	3.3	0.43	0.0	3.27	0.00	0.0	0.00	0.43	15.2	221.16	0.43	0.0	0.00	0.00	0.43
3.4	7328.8	3.4	0.44	0.0	3.27	0.00	0.0	0.00	0.44	15.3	221.88	0.44	0.0	0.00	0.00	0.44
3.5	7328.9	3.5	0.44	0.0	3.27	0.00	0.0	0.00	0.44	15.4	222.61	0.44	0.0	0.00	0.00	0.44
3.6	7329.0	3.6	0.45	0.0	3.27	0.00	0.0	0.00	0.45	15.5	223.33	0.45	0.0	0.00	0.00	0.45
3.7	7329.1	3.7	0.45	0.0	3.27	0.00	0.0	0.00	0.45	15.6	224.05	0.45	0.0	0.00	0.00	0.45
3.8	7329.2	3.8	0.46	0.0	3.27	0.00	0.0	0.00	0.46	15.7	224.76	0.46	0.0	0.00	0.00	0.46
3.9	7329.3	3.9	0.47	0.0	3.27	0.00	0.0	0.00	0.47	15.8	225.48	0.47	0.0	0.00	0.00	0.47
4.0	7329.4	4.0	0.47	0.0	3.27	0.00	0.0	0.00	0.47	15.9	226.19	0.47	0.0	0.00	0.00	0.47
4.1	7329.5	4.1	0.48	0.0	3.27	0.00	0.0	0.00	0.48	16.0	226.90	0.48	0.0	0.00	0.00	0.48
4.2	7329.6	4.2	0.48	0.0	3.27	0.00	0.0	0.00	0.48	16.1	227.61	0.48	0.0	0.00	0.00	0.48
4.3	7329.7	4.3	0.49	0.0	3.27	0.00	0.0	0.00	0.49	16.2	228.31	0.49	0.0	0.00	0.00	0.49
4.4	7329.8	4.4	0.50	0.0	3.27	0.00	0.0	0.00	0.50	16.3	229.02	0.50	0.0	0.00	0.00	0.50
4.5	7329.9	4.5	0.50	0.0	3.27	0.00	0.0	0.00	0.50	16.4	229.72	0.50	0.0	0.00	0.00	0.50
4.6	7330.0	4.6	0.51	0.0	3.27	0.00	0.0	0.00	0.51	16.5	230.42	0.51	0.0	0.00	0.00	0.51
4.7	7330.1	4.7	0.51	0.0	3.27	0.00	0.0	0.00	0.51	16.6	231.12	0.51	0.0	0.00	0.00	0.51
4.8	7330.2	4.8	0.52	0.0	3.27	0.00	0.0	0.00	0.52	16.7	231.81	0.52	0.0	0.00	0.00	0.52
4.9	7330.3	4.9	0.52	0.0	3.27	0.00	0.0	0.00	0.52	16.8	232.50	0.52	0.0	0.00	0.00	0.52
5.0	7330.4	5.0	0.53	0.0	3.27	0.00	0.0	0.00	0.53	16.9	233.19	0.53	0.0	0.00	0.00	0.53
5.1	7330.5	5.1	0.53	0.0	3.27	0.00	0.0	0.00	0.53	17.0	233.88	0.53	0.0	0.00	0.00	0.53
5.2	7330.6	5.2	0.54	0.0	3.27	0.00	0.0	0.00	0.54	17.1	234.57	0.54	0.0	0.00	0.00	0.54
5.3	7330.7	5.3	0.54	0.0	3.27	0.00	0.0	0.00	0.54	17.2	235.26	0.54	0.0	0.00	0.00	0.54
5.4	7330.8	5.4	0.55	0.0	3.27	0.00	0.0	0.00	0.55	17.3	235.94	0.55	0.0	0.00	0.00	0.55
5.5	7330.9	5.5	0.55	0.0	3.27	0.00	0.0	0.00	0.55	17.4	236.62	0.55	0.0	0.00	0.00	0.55
5.6	7331.0	5.6	0.56	0.0	3.27	0.00	0.0	0.00	0.56	17.5	237.30	0.56	0.0	0.00	0.00	0.56
5.7	7331.1	5.7	0.56	0.0	3.27	0.00	0.0	0.00	0.56	17.6	237.98	0.56	0.0	0.00	0.00	0.56
5.8	7331.2	5.8	0.57	0.0	3.27	0.00	0.0	0.00	0.57	17.7	238.65	0.57	0.0	0.00	0.00	0.57
5.9	7331.3	5.9	0.57	0.0	3.27	0.00	0.0	0.00	0.57	17.8	239.32	0.57	0.0	0.00	0.00	0.57
6.0	7331.4	6.0	0.58	0.0	3.27	0.00	0.0	0.00	0.58	17.9	239.99	0.58	0.0	0.00	0.00	0.58
6.1	7331.5	6.1	0.58	0.0	3.27	0.00	0.0	0.00	0.58	18.0	240.66	0.58	0.0	0.00	0.00	0.58
6.2	7331.6	6.2	0.59	0.0	3.27	0.00	0.0	0.00	0.59	18.1	241.33	0.59	0.0	0.00	0.00	0.59
6.3	7331.7	6.3	0.59	0.0	3.27	0.00	0.0	0.00	0.59	18.2	242.00	0.59	0.0	0.00	0.00	0.59
6.4	7331.8	6.4	0.60	0.0	3.27	0.00	0.0	0.00	0.60	18.3	242.66	0.60	0.0	0.00	0.00	0.60
6.5	7331.9	6.5	0.60	0.0	3.27	0.00	0.0	0.00	0.60	18.4	243.32	0.60	0.0	0.00	0.00	0.60
6.6	7332.0	6.6	0.61	0.0	3.27	0.00	0.0	0.00	0.61	18.5	243.98	0.61	0.0	0.00	0.00	0.61
6.7	7332.1	6.7	0.61	0.0	3.27	0.00	0.0	0.00	0.61	18.6	244.64	0.61	0.0	0.00	0.00	0.61
6.8	7332.2	6.8	0.62	0.0	3.27	0.00	0.0	0.00	0.62	18.7	245.30	0.62	0.0	0.00	0.00	0.62
6.9	7332.3	6.9	0.62	0.0	3.27	0.00	0.0	0.00	0.62	18.8	245.95	0.62	0.0	0.00	0.00	0.62
7.0	7332.4	7.0	0.63	0.0	3.27	0.00	0.0	0.00	0.63	18.9	246.61	0.63	0.0	0.00	0.00	0.63
7.1	7332.5	7.1	0.63	0.0	3.27	0.00	0.0	0.00	0.63	19.0	247.26	0.63	0.0	0.00	0.00	0.63
7.2	7332.6	7.2	0.63	0.0	3.27	0.00	0.0	0.00	0.63	19.1	247.91	0.63	0.0	0.00	0.00	0.63
7.3	7332.7	7.3	0.64	0.0	3.27	0.00	0.0	0.00	0.64	19.2	248.56	0.64	0.0	0.00	0.00	0.64
7.4	7332.8	7.4	0.64	0.0	3.27	0.00	0.0	0.00	0.64	19.3	249.20	0.64	0.0	0.00	0.00	0.64
7.5	7332.9	7.5	0.65	0.0	3.27	0.00	0.0	0.00	0.65	19.4	249.85	0.65	0.0	0.00	0.00	0.65
7.6	7333.0	7.6	0.65	0.0	3.27	0.00	0.0	0.00	0.65	19.5	250.49	0.65	0.0	0.00	0.00	0.65
7.7	7333.1	7.7	0.66	0.0	3.27	0.00	0.0	0.00	0.66	19.6	251.13	0.66	0.0	0.00	0.00	0.66
7.8	7333.2	7.8	0.66	0.0	3.27	0.00	0.0	0.00	0.66	19.7	251.77	0.66	0.0	0.00	0.00	0.66
7.9	7333.3	7.9	0.66	0.0	3.27	0.00	0.0	0.00	0.66	19.8	252.41	0.66	0.0	0.00	0.00	0.66
8.0	7333.4	8.0	0.67	0.0	3.27	0.00	0.0	0.00	0.67	19.9	253.05	0.67	0.0	0.00	0.00	0.67
8.1	7333.5	8.1	0.67	0.0	3.27	0.00	0.0	0.00	0.67	20.0	253.68	0.67	0.0	0.00	0.00	0.67

8.2	7333.6	8.2	0.68	0.0	3.27	0.00	0.0	0.00	0.68	20.1	254.32	0.68	0.0	0.00	0.00	0.68
8.3	7333.7	8.3	0.68	0.0	3.27	0.00	0.0	0.00	0.68	20.2	254.95	0.68	0.0	0.00	0.00	0.68
8.4	7333.8	8.4	0.69	0.0	3.27	0.00	0.0	0.00	0.69	20.3	255.58	0.69	0.0	0.00	0.00	0.69
8.5	7333.9	8.5	0.69	0.0	3.27	0.00	0.0	0.00	0.69	20.4	256.21	0.69	0.0	0.00	0.00	0.69
8.6	7334.0	8.6	0.69	0.0	3.27	0.00	0.0	0.00	0.69	20.5	256.83	0.69	0.0	0.00	0.00	0.69
8.7	7334.1	8.7	0.70	0.0	3.27	0.00	0.0	0.00	0.70	20.6	257.46	0.70	0.0	0.00	0.00	0.70
8.8	7334.2	8.8	0.70	0.0	3.27	0.00	0.0	0.00	0.70	20.7	258.08	0.70	0.0	0.00	0.00	0.70
8.9	7334.3	8.9	0.71	0.0	3.27	0.00	0.0	0.00	0.71	20.8	258.71	0.71	0.0	0.00	0.00	0.71
9.0	7334.4	9.0	0.71	0.0	3.27	0.00	0.0	0.00	0.71	20.9	259.33	0.71	0.0	0.00	0.00	0.71
9.1	7334.5	9.1	0.71	0.0	3.27	0.00	0.0	0.00	0.71	21.0	259.95	0.71	0.0	0.00	0.00	0.71
9.2	7334.6	9.2	0.72	0.0	3.27	0.00	0.0	0.00	0.72	21.1	260.57	0.72	0.0	0.00	0.00	0.72
9.3	7334.7	9.3	0.72	0.0	3.27	0.00	0.0	0.00	0.72	21.2	261.18	0.72	0.0	0.00	0.00	0.72
9.4	7334.8	9.4	0.72	0.0	3.27	0.00	0.0	0.00	0.72	21.3	261.80	0.72	0.0	0.00	0.00	0.72
9.5	7334.9	9.5	0.73	0.0	3.27	0.00	0.0	0.00	0.73	21.4	262.41	0.73	0.0	0.00	0.00	0.73
9.6	7335.0	9.6	0.73	0.0	3.27	0.00	0.0	0.00	0.73	21.5	263.02	0.73	0.0	0.00	0.00	0.73
9.7	7335.1	9.7	0.74	0.1	3.27	0.98	0.1	10.76	1.71	21.6	263.63	1.71	0.0	0.00	0.00	1.71
9.8	7335.2	9.8	0.74	0.2	3.27	2.76	0.2	15.22	3.50	21.7	264.24	3.50	0.0	0.00	0.00	3.50
9.9	7335.3	9.9	0.74	0.3	3.28	5.07	0.3	18.64	5.82	21.8	264.85	5.82	0.0	0.00	0.00	5.82
10.0	7335.4	10.0	0.75	0.4	3.28	7.82	0.4	21.53	8.56	21.9	265.46	8.56	0.0	0.00	0.00	8.56
10.1	7335.5	10.1	0.75	0.5	3.28	10.93	0.5	24.07	11.68	22.0	266.06	11.68	0.0	0.00	0.00	11.68
10.2	7335.6	10.2	0.75	0.6	3.28	14.38	0.6	26.36	15.13	22.1	266.67	15.13	0.0	0.00	0.00	15.13
10.3	7335.7	10.3	0.76	0.7	3.28	18.13	0.7	28.48	18.89	22.2	267.27	18.89	0.0	0.00	0.00	18.89
10.4	7335.8	10.4	0.76	0.8	3.29	22.16	0.8	30.44	22.92	22.3	267.87	22.92	0.0	0.00	0.00	22.92
10.5	7335.9	10.5	0.77	0.9	3.29	26.46	0.9	32.29	27.22	22.4	268.47	27.22	0.0	0.00	0.00	27.22
10.6	7336.0	10.6	0.77	1.0	3.29	31.01	1.0	34.04	31.78	22.5	269.07	31.78	0.0	3.27	0.00	31.78
10.7	7336.1	10.7	0.77	1.1	3.29	35.79	1.1	35.70	36.47	22.6	269.67	36.47	0.1	2.44	0.69	37.16
10.8	7336.2	10.8	0.78	1.2	3.29	40.81	1.2	37.28	38.06	22.7	270.26	38.06	0.2	2.51	2.02	40.08
10.9	7336.3	10.9	0.78	1.3	3.30	46.04	1.3	38.81	39.59	22.8	270.86	39.59	0.3	2.58	3.82	43.40
11.0	7336.4	11.0	0.78	1.4	3.30	51.49	1.4	40.27	41.05	22.9	271.45	41.05	0.4	2.63	5.99	47.04
11.1	7336.5	11.1	0.79	1.5	3.30	57.14	1.5	41.68	42.47	23.0	272.04	42.47	0.5	2.68	8.53	51.00
11.2	7336.6	11.2	0.79	1.6	3.30	62.98	1.6	43.05	43.84	23.1	272.63	43.84	0.6	2.69	11.23	55.07
11.3	7336.7	11.3	0.79	1.7	3.30	69.02	1.7	44.38	45.17	23.2	273.22	45.17	0.7	2.67	14.07	59.24
11.4	7336.8	11.4	0.80	1.8	3.31	75.25	1.8	45.66	46.46	23.3	273.81	46.46	0.8	2.66	17.13	63.59
11.5	7336.9	11.5	0.80	1.9	3.31	81.65	1.9	46.91	47.72	23.4	274.40	47.72	0.9	2.65	20.36	68.08
11.6	7337.0	11.6	0.80	2.0	3.31	88.24	2.0	48.13	48.94	23.5	274.99	48.94	1.0	2.65	23.81	72.74
11.7	7337.1	11.7	0.81	2.1	3.31	94.99	2.1	49.32	50.13	23.6	275.57	50.13	1.1	2.64	27.41	77.54
11.8	7337.2	11.8	0.81	2.2	3.31	101.92	2.2	50.48	51.29	23.7	276.15	51.29	1.2	2.64	31.23	82.53
11.9	7337.3	11.9	0.82	2.3	3.32	109.01	2.3	51.62	52.43	23.8	276.73	52.43	1.3	2.64	35.22	87.65
12.0	7337.4	12.0	0.82	2.4	3.32	116.27	2.4	52.73	53.55	23.9	277.32	53.55	1.4	2.66	39.66	93.20
12.1	7337.5	12.1	0.82	2.5	3.32	123.69	2.5	53.81	54.64	24.0	277.90	54.64	1.5	2.68	44.31	98.95
12.2	7337.6	12.2	0.83	2.6	3.32	131.26	2.6	54.88	55.71	24.1	278.47	55.71	1.6	2.68	48.82	104.52
12.3	7337.7	12.3	0.83	2.7	3.32	138.99	2.7	55.93	56.75	24.2	279.05	56.75	1.7	2.68	53.46	110.22
12.4	7337.8	12.4	0.83	2.8	3.33	146.87	2.8	56.95	57.78	24.3	279.63	57.78	1.8	2.70	58.68	116.47
12.5	7337.9	12.5	0.84	2.9	3.33	154.90	2.9	57.96	58.80	24.4	280.20	58.80	1.9	2.72	64.11	122.91
12.6	7338.0	12.6	0.84	3.0	3.33	163.08	3.0	58.95	59.79	24.5	280.77	59.79	2.0	2.74	69.75	129.54
12.7	7338.1	12.7	0.84	3.1	3.33	171.40	3.1	59.92	60.77	24.6	281.35	60.77	2.1	2.86	78.33	139.10
12.8	7338.2	12.8	0.85	3.2	3.33	179.87	3.2	60.88	61.73	24.7	281.92	61.73	2.2	2.77	81.35	143.08
12.9	7338.3	12.9	0.85	3.3	3.34	188.48	3.3	61.83	62.68	24.8	282.49	62.68	2.3	2.79	87.59	150.26
13.0	7338.4	13.0	0.85	3.4	3.34	197.23	3.4	62.76	63.61	24.9	283.06	63.61	2.4	2.81	94.03	157.64

HANSEN ALLEN & LUCE INC

CLIENT UP&L
PROJECT Cottonwood / Willow Hollow
FEATURE Emergency Spillway vs Channel
PROJECT NO.

SHEET 1 OF 1
COMPUTED JMG
CHECKED
DATE 9/4/01

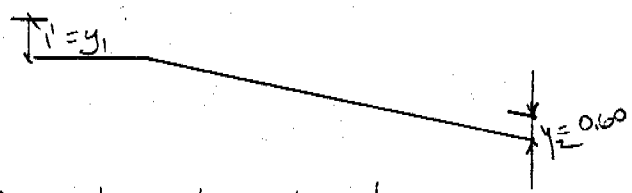
Check discharge of Weir vs. Discharge of Channel

$Q_{25\text{-}6} = 23$ cfs

For $Q = 23$ cfs
$H = 1.0'$
$L = 9'$
$C = 2.65$

$Q = 2.65(9)(1)^{3/2}$
$= 23.9$ cfs

Using Bernoullis Equation & Specific Energy



$y_2 < y_1$

$y = y_2 + \frac{V^2}{2g}$ $\quad V = 3.51$ fps

$= 0.6 + \frac{3.51^2}{2g}$

$= 0.79 < 1$ O.K.

The channel will not have any effect on the weir during the 25-yr 6-hr storm.

Head on the weir during the 25-year, 6-hour event is one foot. During that time the specific energy in the channel is less than the specific energy of the weir. Therefore the channel flow will not effect the weir.

UP&L
COTTONWOOD/WILBERG MINE
DESIGN OF EMERGENCY SPILLWAY

HANSEN, ALLEN, & LUCE
JAH
06-Sep-91

25-YEAR, 6-HOUR EVENT Q (cfs) 23
HEAD (H) ON EMERGENCY SPILLWAY IN SOUTH POND IS TO BE: 1 FT.
USING EQUATION FOR A BROAD CRESTED WEIR
Q=CLH^(3/2)
RANGE IN b (BREADTH OF WEIR) 0.5 TO 15

Q	b	C	H	H^(3/2)	L
23	0.5	3.32	1	1	6.93
23	0.75	3.14	1	1	7.32
23	1	2.98	1	1	7.72
23	1.5	2.75	1	1	8.36
23	2	2.66	1	1	8.65
23	2.5	2.64	1	1	8.71
23	3	2.65	1	1	8.68
23	4	2.67	1	1	8.61
23	5	2.68	1	1	8.58
23	10	2.68	1	1	8.58
23	15	2.63	1	1	8.75

CONSTRUCT A WEIR THAT IS b=3.0 FT. BY L=9.00 FT.

Hansen, Allen, & Luce JAH

UP&L, Cottonwood/Wilberg Mine 11-Sep-91

Emergency Spillway Channel Design

N 0.041 Q=VA

Q=u/nAR^(2/3)S^(1/2)

U 1.49

S% 2.31

A= YB+MY^2

R=A/WP

WP=B+2Y(M^2+1)^(1/2)

B (FT) 9

M 3

Q (CFS) 23

U/N	Y GUESS	AREA	WP	R	R^(2/3)	Q CALC	Q	% DIFF	VELOCITY
36.34	1.00	12.00	15.32	0.78	0.85	56.28	23.00	-59.13	4.69
	0.50	5.25	12.16	0.43	0.57	16.55		38.94	3.15
	0.60	6.48	12.79	0.51	0.64	22.73		1.19	3.51
	0.65	7.12	13.11	0.54	0.67	26.15		-12.04	3.67
	0.61	6.61	12.86	0.51	0.64	23.40		-1.69	3.54

B - Width of Channel across the bottom

N - Mannings N

M - Side slope of Channel

Y - Depth of flow in channel

Y= .60 ft.

HANSEN ALLEN & LUCE inc

CLIENT PACIFICORP
PROJECT Cottonwood/Wilbury Mine Sed. Pond
FEATURE South Pond Spillway & 90" Bypass
PROJECT NO.

SHEET 1 OF 3
COMPUTED GJP
CHECKED
DATE May 92

objective: Define hydraulics of connection of South Pond spillway pipe to 90" Diameter Undisturbed Area Bypass Culvert in 100-year 6-hour storm event. Determine if South Pond spillway pipe is limited by capacity of 90" Diameter Bypass Culvert.

Procedure:

1) Predict 100-yr 6-hour storm peak runoff flowrate to 90" Bypass Culvert.

2) Find flow depth in 90" Bypass Culvert

3) Find head loss associated with connection of South Pond spillway pipe to 90" Bypass Culvert and compute required water surface elevation in South Pond Spillway riser to introduce peak 100-yr 6-hour storm runoff flowrate from South Pond into 90" Bypass

Solution:

1) Using a rainfall of 2.3 inches (100-yr 6-hr NOAA ATLAS 2, Volume VI-Utah) and HEC-1 model of undisturbed Bypass system prepared for "Hydrologic Analysis of Undisturbed and Disturbed ... Cottonwood/Wilbury Mine Portal Site ..." (HA&L, June 1989), the predicted 100-yr 6-hr peak runoff flow to the 90" Diameter Bypass Culvert is 320 cfs (see attached HEC-1 printout page 9). If peak discharge from South Pond (33 cfs) is added directly to 320 cfs, then the total peak flow is <u>353 cfs.</u>

2) Find flow depth in 90" Diameter Bypass:

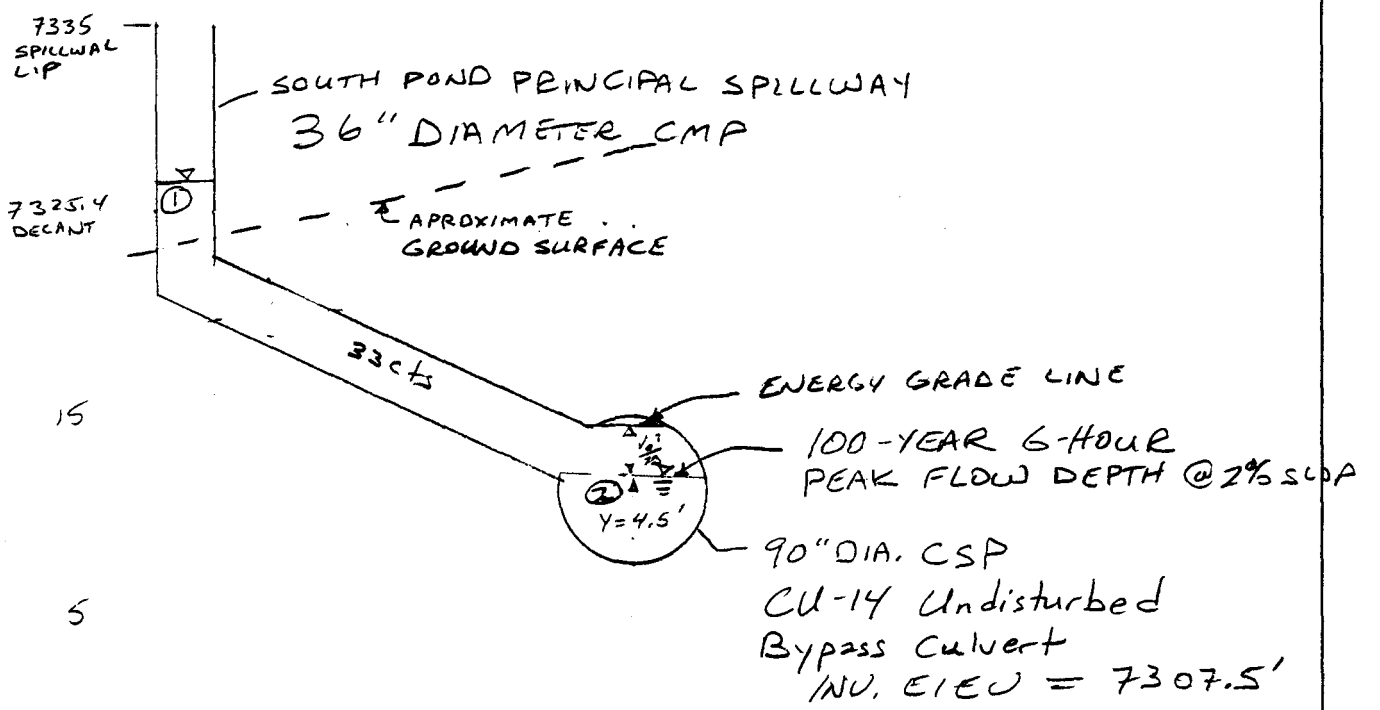
Slope = 2% (Roberts Schaefer, Drawing Number 7704-0122)

Mannings Equation: $Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{S}$

C CFS	D FT	Y FT	AREA FTE	FRE	V FPS	E FT	V	Sa FT/FT	Sf FT/FT
353	7.5	4.505	27.716	1.336	12.736	7.0	0.027	0.020	0.0200

3) South Pond Spillway pipe connection to 90" Bypass Culvert.

SCHEMATE: 1" ≈ 10'



FIND required water depth (head) in riser to introduce 33 cfs into 90" DIA. CSP

Bernoulli Energy at PT ① = Energy at PT ② − losses

$$① \quad \frac{P_1}{\gamma} + \frac{V_1^2}{2g} + Z_1 = \underbrace{\frac{P_2}{\gamma} + \frac{V_2^2}{2g}} + \Sigma h_L + Z_2$$

$$\text{Energy @ ①} = 7.02' + 7307.5 + \Sigma h_L$$

$$\text{Energy @ ①} = 7314.5 + \Sigma h_L$$

Σh_L = pipe friction loss + 90° BEND + Exit loss

- Pipe friction loss: 36" Dia CMP $n = .024$

$Q = 33$ cfs $\Rightarrow S_f = \left(\frac{33}{8.69/.024}\right)^2$

$S_f = 0.0083$ ft/ft

assume total length = 33'

∴ Pipe friction loss = 33 (.0083) = 0.3'

90° Bend Loss $= K_b \frac{V_{36''}^2}{2g}$

reference: "Handbook of Hydraulics" Brater & King 1976

$K_b \cong 0.4$ use $K_b = 0.5$ to be conservative

$V = \frac{Q}{A} = \frac{33 \text{ cfs}}{7.07 \text{ ft}^2} = 4.7 \text{ fps}$

$\therefore$ bend loss $= 0.5 \frac{4.7^2}{2g} = \underline{0.17'}$

EXIT LOSS $= \frac{V_{36''}^2}{2g} = \underline{0.34'}$

Total $\Sigma h_L = 0.3' + .17' + 0.34' = 0.81'$

$\therefore$ W.S. Elev in riser $= 7314.5 + 0.81 = \underline{7315.3'}$

This is much less than the available head (i.e. 7315.3 < 7335) therefore capacity of the 90" DIAMETER BYPASS CULVERT and the spillway pipe do not limit the capacity of the spillway.

The capacity of the spillway riser is dependent on weir and orifice flow hydraulics at the inlet.

1

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FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

Undisturbed By pass system
100-year 6-hour

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          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID    UP&L Mining
            2           ID    Cottonwood/Wilberg Mine Portal Undisturbed Bypass Facilities
            3           ID    100-YR 6-HR  SCS 6-HOUR DISTRIBUTION
            4           ID    by gjp Hansen, Allen & Luce  June, 1989
*** FREE ***
                        *DIAGRAM
            5           IT       2       0       0     200
            6           IO       5

            7           KK    UA-1
            8           BA    2.45
            9           PB     2.3
           10           IN     30.
           11           PI      0.    .035    .045    .055    .095     .37      .1     .08    .055     .05
           12           PI     .04     .04    .035
           13           LS       0      66      0.
           14           UD    0.76

           15           KK    CU-1 ROUTE THROUGH CULVERT
           16           RK    240.     .10    .015            CIRC       6

           17           KK    UA-2
           18           BA   .0186
           19           LS       0      85       0
           20           UD     .06

           21           KK    CU-3  COMBINE AT CULVERT CU-3
           22           HC       2

           23           KK    CU-3 ROUTE THROUGH CULVERT
           24           RK    610.     .10    .015            CIRC       6

           25           KK    UA-3
           26           BA    .053
           27           LS       0      76       0
           28           UD     .10

           29           KK    CU-4 ROUTE THROUGH CULVERT
           30           RK    750.     .20    .015            CIRC       2

           31           KK    CU-5  COMBINE AT CULVERT CU-5
           32           HC       2

           33           KK    UA-4
           34           BA   .0514
           35           LS       0      76       0
           36           UD     .07

           37           KK    CU-7  COMBINE AT CULVERT CU-7
           38           HC       2
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  39          KK    CU-7 ROUTE THROUGH CULVERT
  40          RK    500.     .10    .015            CIRC       6

  41          KK    UA-5
  42          BA   .0183
  43          LS       0      85       0
  44          UD     .06

  45          KK    UA-6
  46          BA    2.03
  47          LS       0      73       0
  48          UD     .65

  49          KK    CU-8COMBINE AT CULVERT CU-8
  50          HC       2

  51          KK    UA-7
  52          BA   .0984
  53          LS       0      76       0
  54          UD     .13

  55          KK    UA-8
  56          BA    .005
  57          LS       0      76       0
  58          UD     .06

  59          KK    UA-9
  60          BA   .0013
  61          LS       0      85       0
  62          UD     .06

  63          KK   CU-13 COMBINE AT CULVERT CU-13
  64          HC       4

  65          KK   CU-13 ROUTE THROUGH CULVERT
  66          RK    450.     .30    .015            CIRC       6

  67          KK   CU-14 COMBINE AT CULVERT CU-14
  68          HC       2

  69          KK   CU-14 ROUTE THROUGH CULVERT
  70          RK   1000.     .10    .015            CIRC     7.5

  71          KK   UA-10
  72          BA   .0141
  73          LS       0      76       0
  74          UD     .07

  75          KK   UA-11
  76          BA    .062
  77          LS       0      76       0
  78          UD     .10
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  79          KKCONVENIENCE COMBINATION
  80          KO        1
  81          HC        3
  82          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7       UA-1
               V
               V
   15       CU-1
               .
               .
   17          .        UA-2
               .           .
               .           .
   21       CU-3............
               V
               V
   23       CU-3
               .
               .
   25          .        UA-3
               .           V
               .           V
   29          .        CU-4
               .           .
               .           .
   31       CU-5............
               .
               .
   33          .        UA-4
               .           .
               .           .
   37       CU-7............
               V
               V
   39       CU-7
               .
               .
   41          .        UA-5
               .           .
               .           .
   45          .           .        UA-6
               .           .           .
               .           .           .
   49          .        CU-8............
               .           .
               .           .
   51          .           .        UA-7
               .           .           .
               .           .           .
   55          .           .           .        UA-8
               .           .           .           .
               .           .           .           .
   59          .           .           .           .        UA-9
               .           .           .           .           .
               .           .           .           .           .
```

```
63          .       CU-13.................................
            .           V
            .           V
65          .       CU-13
            .           .
            .           .
67      CU-14............
            V
            V
69      CU-14
            .
            .
71          .       UA-10
            .           .
            .           .
75          .           .       UA-11
            .           .           .
            .           .           .
79    CONVENIE......................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

****
FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

UP&L Mining
Cottonwood/Wilberg Mine Portal Undisturbed Bypass Facilities
100-YR 6-HR SCS 6-HOUR DISTRIBUTION
by gjp Hansen, Allen & Luce June, 1989

```
 6 IO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

  IT           HYDROGRAPH TIME DATA
                      NMIN           2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1    0  ENDING DATE
                    NDTIME        0638  ENDING TIME

                COMPUTATION INTERVAL     .03 HOURS
                     TOTAL TIME BASE    6.63 HOURS

        ENGLISH UNITS
```

*** ***

```
                **************
                *            *
 79 KK          *  CONVENIE  *      NCE COMBINATION
                *            *
                **************

 80 KO              OUTPUT CONTROL VARIABLES
                          IPRNT           1  PRINT CONTROL
                          IPLOT           0  PLOT CONTROL
                          QSCAL          0.  HYDROGRAPH PLOT SCALE

 81 HC              HYDROGRAPH COMBINATION
                          ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***
```

HYDROGRAPH AT STATION CONVENIE
SUM OF 3 HYDROGRAPHS

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
					(columns continued from p. 8)					(columns continued from p. 8)					(columns continued from p. 8)				
1		0000	1	0.	1		0140	51	0.	1		0320	101	184.	1		0500	151	285.
1		0002	2	0.	1		0142	52	0.	1		0322	102	199.	1		0502	152	283.
1		0004	3	0.	1		0144	53	0.	1		0324	103	213.	1		0504	153	281.
1		0006	4	0.	1		0146	54	0.	1		0326	104	228.	1		0506	154	279.
1		0008	5	0.	1		0148	55	0.	1		0328	105	241.	1		0508	155	276.
1		0010	6	0.	1		0150	56	0.	1		0330	106	253.	1		0510	156	274.
1		0012	7	0.	1		0152	57	0.	1		0332	107	265.	1		0512	157	272.
1		0014	8	0.	1		0154	58	0.	1		0334	108	274.	1		0514	158	271.
1		0016	9	0.	1		0156	59	0.	1		0336	109	282.	1		0516	159	269.
1		0018	10	0.	1		0158	60	0.	1		0338	110	289.	1		0518	160	268.
1		0020	11	0.	1		0200	61	0.	1		0340	111	295.	1		0520	161	267.
1		0022	12	0.	1		0202	62	0.	1		0342	112	301.	1		0522	162	265.
1		0024	13	0.	1		0204	63	0.	1		0344	113	306.	1		0524	163	264.
1		0026	14	0.	1		0206	64	0.	1		0346	114	311.	1		0526	164	262.
1		0028	15	0.	1		0208	65	0.	1		0348	115	315.	1		0528	165	261.
1		0030	16	0.	1		0210	66	0.	1		0350	116	318.	1		0530	166	259.
1		0032	17	0.	1		0212	67	0.	1		0352	117	321.	1		0532	167	258.
1		0034	18	0.	1		0214	68	0.	1		0354	118	323.	1		0534	168	256.
1		0036	19	0.	1		0216	69	0.	1		0356	119	325.	1		0536	169	255.
1		0038	20	0.	1		0218	70	0.	1		0358	120	326.	1		0538	170	253.
1		0040	21	0.	1		0220	71	1.	1		0400	121	327.	1		0540	171	252.
1		0042	22	0.	1		0222	72	1.	1		0402	122	328.	1		0542	172	250.
1		0044	23	0.	1		0224	73	1.	1		0404	123	327.	1		0544	173	249.
1		0046	24	0.	1		0226	74	1.	1		0406	124	325.	1		0546	174	247.
1		0048	25	0.	1		0228	75	1.	1		0408	125	324.	1		0548	175	246.
1		0050	26	0.	1		0230	76	1.	1		0410	126	323.	1		0550	176	245.
1		0052	27	0.	1		0232	77	2.	1		0412	127	322.	1		0552	177	244.
1		0054	28	0.	1		0234	78	3.	1		0414	128	321.	1		0554	178	243.
1		0056	29	0.	1		0236	79	6.	1		0416	129	321.	1		0556	179	242.
1		0058	30	0.	1		0238	80	10.	1		0418	130	321.	1		0558	180	241.
1		0100	31	0.	1		0240	81	14.	1		0420	131	320.	1		0600	181	240.
1		0102	32	0.	1		0242	82	21.	1		0422	132	320.	1		0602	182	239.

(columns continued on next page) (columns continued on next page) (columns continued on next page) (columns continued on next page)

DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0104	33	0.	*	1		0244	83	29.	*	1		0424	133	319.	*	1		0604	183	238.
1		0106	34	0.	*	1		0246	84	39.	*	1		0426	134	318.	*	1		0606	184	237.
1		0108	35	0.	*	1		0248	85	49.	*	1		0428	135	317.	*	1		0608	185	236.
1		0110	36	0.	*	1		0250	86	59.	*	1		0430	136	315.	*	1		0610	186	235.
1		0112	37	0.	*	1		0252	87	70.	*	1		0432	137	314.	*	1		0612	187	234.
1		0114	38	0.	*	1		0254	88	82.	*	1		0434	138	312.	*	1		0614	188	233.
1		0116	39	0.	*	1		0256	89	94.	*	1		0436	139	309.	*	1		0616	189	233.
1		0118	40	0.	*	1		0258	90	107.	*	1		0438	140	307.	*	1		0618	190	232.
1		0120	41	0.	*	1		0300	91	121.	*	1		0440	141	305.	*	1		0620	191	232.
1		0122	42	0.	*	1		0302	92	131.	*	1		0442	142	303.	*	1		0622	192	232.
1		0124	43	0.	*	1		0304	93	133.	*	1		0444	143	300.	*	1		0624	193	231.
1		0126	44	0.	*	1		0306	94	129.	*	1		0446	144	298.	*	1		0626	194	231.
1		0128	45	0.	*	1		0308	95	126.	*	1		0448	145	296.	*	1		0628	195	230.
1		0130	46	0.	*	1		0310	96	127.	*	1		0450	146	294.	*	1		0630	196	229.
1		0132	47	0.	*	1		0312	97	133.	*	1		0452	147	292.	*	1		0632	197	228.
1		0134	48	0.	*	1		0314	98	142.	*	1		0454	148	291.	*	1		0634	198	224.
1		0136	49	0.	*	1		0316	99	155.	*	1		0456	149	289.	*	1		0636	199	219.
1		0138	50	0.	*	1		0318	100	169.	*	1		0458	150	287.	*	1		0638	200	215.

(columns continued on p. 7) * (columns continued on P. 7) * (columns continued on p. 7) *

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 328.	4.03		162.	147.	147.	147.
		(INCHES)	.314	.314	.314	.314
		(AC-FT)	80.	80.	80.	80.

CUMULATIVE AREA = 4.80 SQ MI

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	UA-1	112.	4.60	53.	48.	48.	2.45		
+	ROUTED TO	CU-1	112.	4.60	53.	48.	48.	2.45		
+	HYDROGRAPH AT	UA-2	11.	3.00	2.	2.	2.	.02		
+	2 COMBINED AT	CU-3	114.	4.57	55.	50.	50.	2.47		
+	ROUTED TO	CU-3	114.	4.60	55.	50.	50.	2.47		
+	HYDROGRAPH AT	UA-3	16.	3.03	3.	3.	3.	.05		
+	ROUTED TO	CU-4	16.	3.03	3.	3.	3.	.05		
+	2 COMBINED AT	CU-5	119.	4.57	58.	53.	53.	2.52		
+	HYDROGRAPH AT	UA-4	16.	3.00	3.	3.	3.	.05		
+	2 COMBINED AT	CU-7	123.	4.57	61.	56.	56.	2.57		
+	ROUTED TO	CU-7	123.	4.57	61.	55.	55.	2.57		
+	HYDROGRAPH AT	UA-5	11.	3.00	2.	2.	2.	.02		
+	HYDROGRAPH AT	UA-6	202.	3.80	88.	80.	80.	2.03		
+	2 COMBINED AT	CU-8	205.	3.80	90.	81.	81.	2.05		
+	HYDROGRAPH AT	UA-7	27.	3.07	6.	5.	5.	.10		
+	HYDROGRAPH AT	UA-8	2.	3.00	0.	0.	0.	.00		
	HYDROGRAPH AT									

+		UA-9	1.	3.00	0.	0.	0.	.00
	4 COMBINED AT							
+		CU-13	216.	3.80	97.	87.	87.	2.15
	ROUTED TO							
+		CU-13	216.	3.80	97.	87.	87.	2.15
	2 COMBINED AT							
+		CU-14	320.	4.03	158.	143.	143.	4.73
	ROUTED TO							
+		CU-14	319.	4.03	158.	143.	143.	4.73
	HYDROGRAPH AT							
+		UA-10	4.	3.00	1.	1.	1.	.01
	HYDROGRAPH AT							
+		UA-11	19.	3.03	4.	3.	3.	.06
	3 COMBINED AT							
+		CONVENIE	328.	4.03	162.	147.	147.	4.80

*** NORMAL END OF HEC-1 ***

Stage-Capacity Calculations
North and South Ponds

HANSEN, ALLEN, & LUCE
UP&L
COTTONWOOD/WILBURG MINE
STAGE - CAPACITY SOUTH POND

JAH
06-Sep-91

ELEVATION (FEET)	AREA (FT^2)	AVG. AREA (FT^2)	VOL (FT^3)	SUM VOL. (FT^3)	SUM VOL. (ACRE-FT.)
		0.00	0.00	0.00	0.00
7318.0	489.60				
		686.97	1373.93	1373.93	0.03
7320.0	884.33				
		1202.57	2405.14	3779.07	0.09
7322.0	1520.81				
		2252.15	4504.29	8283.36	0.19
7324.0	2983.48				
		3664.32	7328.64	15612.00	0.36
7326.0	4345.16				
		4877.60	9755.20	25367.20	0.58
7328.0	5410.04				
		6034.28	12068.55	37435.75	0.86
7330.0	6658.51				
		7397.49	14794.98	52230.73	1.20
7332.0	8136.47				
		9063.65	18127.29	70358.02	1.62
7334.0	9990.82				
		10999.08	21998.16	92356.18	2.12
7336.0	12007.34				

HANSEN, ALLEN, & LUCE
UP&L
COTTONWOOD/WILBURG MINE
STAGE - CAPACITY NORTH POND

JAH
06-Sep-91

ELEVATION (FEET)	AREA (FT^2)	AVG. AREA (FT^2)	VOL (FT^3)	SUM VOL. (FT^3)	SUM VOL. (ACRE-FT.)
		0.00	0.00	0.00	0.00
7346.0	911.87				
		1197.98	2395.96	2395.96	0.06
7348.0	1484.09				
		1869.65	3739.29	6135.25	0.14
7350.0	2255.20				
		2689.72	5379.43	11514.68	0.26
7352.0	3124.23				
		3800.49	7600.97	19115.65	0.44
7354.0	4476.74				
		5024.48	10048.95	29164.60	0.67
7356.0	5572.21				
		6164.32	12328.63	41493.23	0.95
7358.0	6756.42				
		7412.79	14825.57	56318.80	1.29
7360.0	8069.15				
		8639.84	17279.67	73598.47	1.69
7362.0	9210.52				
		9902.08	19804.15	93402.62	2.14
7364.0	10593.63				
		11334.15	22668.29	116070.91	2.66
7366.0	12074.66				

HEC-1 Model Output
100-Year, 6-Hour Precipitation Event

1

****
FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

100-YR 6-HR PRECIP EVENT

HEC-1 INPUT

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

             1          ID     UP&L Mining - Wilberg Mine Portal Facilities
             2          ID     100-YR 6-HR  SCS 6-HOUR DISTRIBUTION
             3          ID     by gjp Hansen, Allen & Luce  May 1989
             4          ID     corrections made March 3, 1992, gjp
*** FREE ***
                        *DIAGRAM
             5          IT       1       0       0     300
             6          IO       5

             7          KK    DA-1
             8          BA   .0088
             9          PB    2.24
            10          IN     30.
            11          PI      0.    .035    .045    .055    .095     .37      .1     .08    .055     .05
            12          PI     .04     .04    .035
            13          LS       0    91.1      0.
            14          UD    .064

            15          KK    CD-1 ROUTE THROUGH CULVERT
            16          RK    100.     1.0    .015            CIRC       2

            17          KK   ROUTE around parking lot from Culvert CD-1 to CD-4
            18          RK    340.     .02    .025            TRAP       1       2

            19          KK    DA-2
            20          BA  .00403
            21          LS       0      91       0
            22          UD    .067

            23          KK    CD-2 ROUTE THROUGH CULVERT
            24          RK    175.     .71    .015            CIRC     1.5

            25          KK   ROUTE around parking lot from Culvert CD-2 to CD-4
            26          RK    260.     .02    .025            TRAP       1       2

            27          KK    DA-3
            28          BA   .0022
            29          LS       0      89       0
            30          UD    .065

            31          KK    CD-3 ROUTE THROUGH CULVERT
            32          RK     75.     .77    .015            CIRC     1.0

            33          KK   ROUTE around parking lot from Culvert CD-3 to CD-4
            34          RK    400.     .02    .025            TRAP       1       2

            35          KK    DA-4
            36          BA   .0046
            37          LS       0      92       0
            38          UD    .085
```

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 39           KK    CD-4  COMBINE AT CULVERT CD-4
 40           HC       4

 41           KK    CD-4 ROUTE THROUGH CULVERT
 42           RK    154.     .19    .015            CIRC       2

 43           KK    DA-5
 44           BA  .00022
 45           LS       0      96       0
 46           UD    .058

 47           KK COMBINEAT CULVERT CD-5
 48           HC       2

 49           KK    CD-5 ROUTE THROUGH CULVERT
 50           RK     75.     .77    .015            CIRC       2

 51           KK    DA-6
 52           BA  .00648
 53           LS       0      82       0
 54           UD    .063

 55           KK COMBINEAT CULVERT CD-6
 56           HC       2

 57           KK    CD-6 ROUTE THROUGH CULVERT
 58           RK    140.     .36    .015            CIRC       2

 59           KK    DA-7
 60           KM    DA-7 is tributary to Culvert CD-7 which is connected to CD-8
 61           BA  .00275
 62           LS       0      92       0
 63           UD    .059

 64           KK    DA-8
 65           BA  .00022
 66           LS       0      98       0
 67           UD    .058

 68           KK COMBINEAT CULVERT CD-8
 69           HC       2

 70           KK    CD-8 ROUTE THROUGH CULVERT
 71           RK    120.     .33    .015            CIRC    1.33

 72           KK COMBINEAT CULVERT CD-8
 73           HC       2

 74           KK    CD-8 ROUTE THROUGH CULVERT
 75           RK    160.     .03    .015            CIRC     2.5
```

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  76          KK    DA-9
  77          BA  .00389
  78          LS       0       89       0
  79          UD    .079

  80          KK COMBINEAT CULVERT CD-9
  81          HC       2

  82          KK    CD-9 ROUTE THROUGH CULVERT
  83          RK    120.     .33    .015            CIRC     2.5

  84          KK   DA-10
  85          BA  .00075
  86          LS       0       92       0
  87          UD    .058

  88          KK COMBINEAT CULVERT CD-10
  89          HC       2

  90          KK   CD-10 ROUTE THROUGH CULVERT
  91          RK    105.     .31    .015            CIRC     2.5

  92          KK   DA-11
  93          BA   .0019
  94          LS       0     92.8       0
  95          UD    .058

  96          KK COMBINEAT CULVERT CD-11
  97          HC       2

  98          KK   CD-11 ROUTE THROUGH CULVERT
  99          RK    300.    .066    .015            CIRC     2.5

 100          KK   DA-12
 101          BA  .00048
 102          LS       0       98       0
 103          UD    .065

 104          KK   CD-12 ROUTE THROUGH CULVERT
 105          RK     95.     .26    .015            CIRC     1.2

 106          KK   DA-13
 107          BA  .00016
 108          LS       0       98       0
 109          UD    .058

 110          KK   CD-13 ROUTE THROUGH CULVERT
 111          RK    100.     .06    .015            CIRC    1.33
```

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 112          KK   DA-14
 113          BA  .00113
 114          LS       0       92        0
 115          UD    .058

 116          KK   CD-14 ROUTE THROUGH CULVERT
 117          RK     60.      .16     .015             CIRC      1.2

 118          KK   DA-17
 119          BA  .00141
 120          LS       0     88.5        0
 121          UD    .107

 122          KK   NORTHCOMBINE AT NORTH POND
 123          HC       5

 124          KK    POND1
 125          KM
 126          RS       1     ELEV     65.0
 127          SV       0      .06      .14      .26      .44      .67      .95     1.29     1.69     2.14
 128          SV    2.66     2.92
 129          SE    46.0     48.0     50.0     52.0     54.0     56.0     58.0     60.0     62.0     64.0
 130          SE    66.0     67.0
 131          SQ       0      .46      .82     1.06     1.25     1.34     4.11     6.43    12.31    19.52
 132          SQ   23.56    32.43    41.48    45.32    54.07    63.97     69.3    80.63
 133          SE    56.5     58.0     60.0     62.0     64.0     65.0     65.2     65.3     65.5     65.7
 134          SE    65.8     66.0     66.2     66.3     66.5     66.7     66.8     67.0

 135          KK   DA-15
 136          BA  .00045
 137          LS       0       98        0
 138          UD    .058

 139          KK   CD-15 ROUTE THROUGH CULVERT
 140          RK     50.      .15     .015             CIRC        1

 141          KK   DA-16
 142          BA  .00031
 143          LS       0       98        0
 144          UD    .058

 145          KK   CD-16 ROUTE THROUGH CULVERT
 146          RK     40.      .15     .015             CIRC        1

 147          KK   DA-18
 148          BA  .00134
 149          LS       0       88        0
 150          UD    .062
```

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 151          KK   SOUTHCOMBINE AT SOUTH POND
 152          HC       4

 153          KK    POND2
 154          KM
 155          RS       1    ELEV    35.0
 156          SV       0     .03     .09     .19     .36     .58     .86    1.20    1.62    2.12
 157          SV    2.37
 158          SE    18.0    20.0    22.0    24.0    26.0    28.0    30.0    32.0    34.0    36.0
 159          SE    37.0
 160          SQ       0     .29     .44     .55     .65     .73     3.5    5.81   11.68    18.9
 161          SQ    22.9    31.8    40.0   43.29   50.84   59.32   63.65   72.78
 162          SE    25.5    27.0    29.0    31.0    33.0    35.0    35.2    35.3    35.5    35.7
 163          SE    35.8    36.0    36.2    36.3    36.5    36.7    36.8    37.0
 164          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7        DA-1
               V
               V
  15        CD-1
               V
               V
  17       ROUTE
               .
               .
  19           .        DA-2
               .           V
               .           V
  23           .        CD-2
               .           V
               .           V
  25           .       ROUTE
               .           .
               .           .
  27           .           .        DA-3
               .           .           V
               .           .           V
  31           .           .        CD-3
               .           .           V
               .           .           V
  33           .           .       ROUTE
               .           .           .
               .           .           .
  35           .           .           .        DA-4
               .           .           .           .
               .           .           .           .
  39        CD-4.......................................
               V
               V
  41        CD-4
               .
               .
  43           .        DA-5
               .           .
               .           .
  47     COMBINE............
               V
               V
  49        CD-5
               .
               .
  51           .        DA-6
               .           .
               .           .
  55     COMBINE............
               V
               V
  57        CD-6
               .
               .
  59           .        DA-7
               .           .
```

```
 64          .           .        DA-8
             .           .           .
             .           .           .
 68          .     COMBINE............
             .           V
             .           V
 70          .        CD-8
             .           .
             .           .
 72     COMBINE............
             V
             V
 74        CD-8
             .
             .
 76          .        DA-9
             .           .
             .           .
 80     COMBINE............
             V
             V
 82        CD-9
             .
             .
 84          .       DA-10
             .           .
             .           .
 88     COMBINE............
             V
             V
 90       CD-10
             .
             .
 92          .       DA-11
             .           .
             .           .
 96     COMBINE............
             V
             V
 98       CD-11
             .
             .
100          .       DA-12
             .           V
             .           V
104          .       CD-12
             .           .
             .           .
106          .           .       DA-13
             .           .           V
             .           .           V
110          .           .       CD-13
             .           .           .
             .           .           .
112          .           .           .       DA-14
             .           .           .           V
             .           .           .           V
116          .           .           .       CD-14
             .           .           .           .
             .           .           .           .
118          .           .           .           .       DA-17
             .           .           .           .           .
```

```
                .          .          .          .          .
122        NORTH.............................................
               V
               V
124         POND
                .
                .
135             .       DA-15
                .           V
                .           V
139             .       CD-15
                .           .
                .           .
141             .           .       DA-16
                .           .           V
                .           .           V
145             .           .       CD-16
                .           .           .
                .           .           .
147             .           .           .       DA-18
                .           .           .           .
                .           .           .           .
151        SOUTH.................................
               V
               V
153         POND
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

****
FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

UP&L Mining - Wilberg Mine Portal Facilities
100-YR 6-HR SCS 6-HOUR DISTRIBUTION
by gjp Hansen, Allen & Luce May 1989
corrections made March 3, 1992, gjp

```
6 IO        OUTPUT CONTROL VARIABLES
                 IPRNT          5  PRINT CONTROL
                 IPLOT          0  PLOT CONTROL
                 QSCAL         0.  HYDROGRAPH PLOT SCALE

  IT        HYDROGRAPH TIME DATA
                  NMIN          1  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1    0  STARTING DATE
                 ITIME        0000  STARTING TIME
                    NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      1    0  ENDING DATE
                NDTIME        0459  ENDING TIME

          COMPUTATION INTERVAL     .02 HOURS
               TOTAL TIME BASE    4.98 HOURS

     ENGLISH UNITS
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	DA-1	8.	3.00	2.	2.	2.	.01		
+	ROUTED TO	CD-1	8.	3.00	2.	2.	2.	.01		
+	ROUTED TO	ROUTE	8.	3.02	2.	2.	2.	.01		
+	HYDROGRAPH AT	DA-2	4.	3.00	1.	1.	1.	.00		
+	ROUTED TO	CD-2	4.	3.00	1.	1.	1.	.00		
+	ROUTED TO	ROUTE	4.	3.02	1.	1.	1.	.00		
+	HYDROGRAPH AT	DA-3	2.	3.00	0.	0.	0.	.00		
+	ROUTED TO	CD-3	2.	3.00	0.	0.	0.	.00		
+	ROUTED TO	ROUTE	2.	3.02	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-4	5.	3.00	1.	1.	1.	.00		
+	4 COMBINED AT	CD-4	19.	3.02	3.	3.	3.	.02		
+	ROUTED TO	CD-4	19.	3.02	3.	3.	3.	.02		
+	HYDROGRAPH AT	DA-5	0.	2.98	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	19.	3.02	3.	3.	3.	.02		
+	ROUTED TO	CD-5	19.	3.02	3.	3.	3.	.02		
+	HYDROGRAPH AT	DA-6	4.	3.02	1.	1.	1.	.01		
+	2 COMBINED AT	COMBINE	23.	3.02	4.	4.	4.	.03		
+	ROUTED TO	CD-6	23.	3.02	4.	4.	4.	.03		

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	DA-7	3.	3.00	1.	1.	1.	.00		
+	HYDROGRAPH AT	DA-8	0.	2.93	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	3.	3.00	1.	1.	1.	.00		
+	ROUTED TO	CD-8	3.	3.00	1.	1.	1.	.00		
+	2 COMBINED AT	COMBINE	26.	3.02	5.	5.	5.	.03		
+	ROUTED TO	CD-8	26.	3.02	5.	5.	5.	.03		
+	HYDROGRAPH AT	DA-9	3.	3.02	1.	1.	1.	.00		
+	2 COMBINED AT	COMBINE	29.	3.02	5.	5.	5.	.03		
+	ROUTED TO	CD-9	29.	3.02	5.	5.	5.	.03		
+	HYDROGRAPH AT	DA-10	1.	3.00	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	30.	3.02	5.	5.	5.	.03		
+	ROUTED TO	CD-10	30.	3.02	5.	5.	5.	.03		
+	HYDROGRAPH AT	DA-11	2.	3.00	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	32.	3.02	6.	6.	6.	.04		
+	ROUTED TO	CD-11	32.	3.02	6.	6.	6.	.04		
+	HYDROGRAPH AT	DA-12	1.	2.98	0.	0.	0.	.00		
+	ROUTED TO	CD-12	1.	2.98	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-13	0.	2.95	0.	0.	0.	.00		
+	ROUTED TO	CD-13	0.	2.95	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-14	1.	3.00	0.	0.	0.	.00		

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	ROUTED TO	CD-14	1.	3.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-17	1.	3.02	0.	0.	0.	.00		
+	5 COMBINED AT	NORTH	35.	3.02	6.	6.	6.	.04		
+	ROUTED TO	POND	33.	3.03	6.	6.	6.	.04	66.02	3.03
+	HYDROGRAPH AT	DA-15	1.	3.00	0.	0.	0.	.00		
+	ROUTED TO	CD-15	1.	3.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-16	0.	2.95	0.	0.	0.	.00		
+	ROUTED TO	CD-16	0.	2.95	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-18	1.	3.00	0.	0.	0.	.00		
+	4 COMBINED AT	SOUTH	35.	3.03	7.	7.	7.	.04		
+	ROUTED TO	POND	33.	3.08	6.	6.	6.	.04	36.04	3.08

*** NORMAL END OF HEC-1 ***

Detention Time Calculations
Between the Inflow Hydrograph Into the North Pond
and the Outflow Hydrograph from the South Pond
10-Year, 24-Hour Precipitation Event

HANSEN ALLEN & LUCE INC

CLIENT PACIFIC CORP
PROJECT Cottonwood / Wilburg Mine
FEATURE 10-yr 24-hr Detention Time
PROJECT NO. 5

SHEET 1 OF 4
COMPUTED GLP
CHECKED
DATE Sep 91

Find detention time between 10-year 24-hour storm hydrograph into North Pond and routed outflow from South Pond. Detention time is defined as the time interval between the centroids of the inflow and outflow hydrographs.

The 10-year 24-hour storm runoff hydrograph inflowing to the north pond was predicted using the model prepared for "Hydrologic Analysis of Undisturbed and Disturbed Area Runoff Control ... Cottonwood/Wilburg Mine Portal Site," (HA&L, 1989).

The HEC-1 input was modified to include the stage-volume and stage-discharge information for the North Pond and South Pond. (see HEC-1 input and output attached).

The volume of each hydrograph was then found by summing the total volume of the hydrograph for each time step and adding. The hydrograph centroid was then found by dividing the volume of the hydrograph by two and interpolating to find the time associated with half of the hydrograph volume. (see attached spreadsheet)

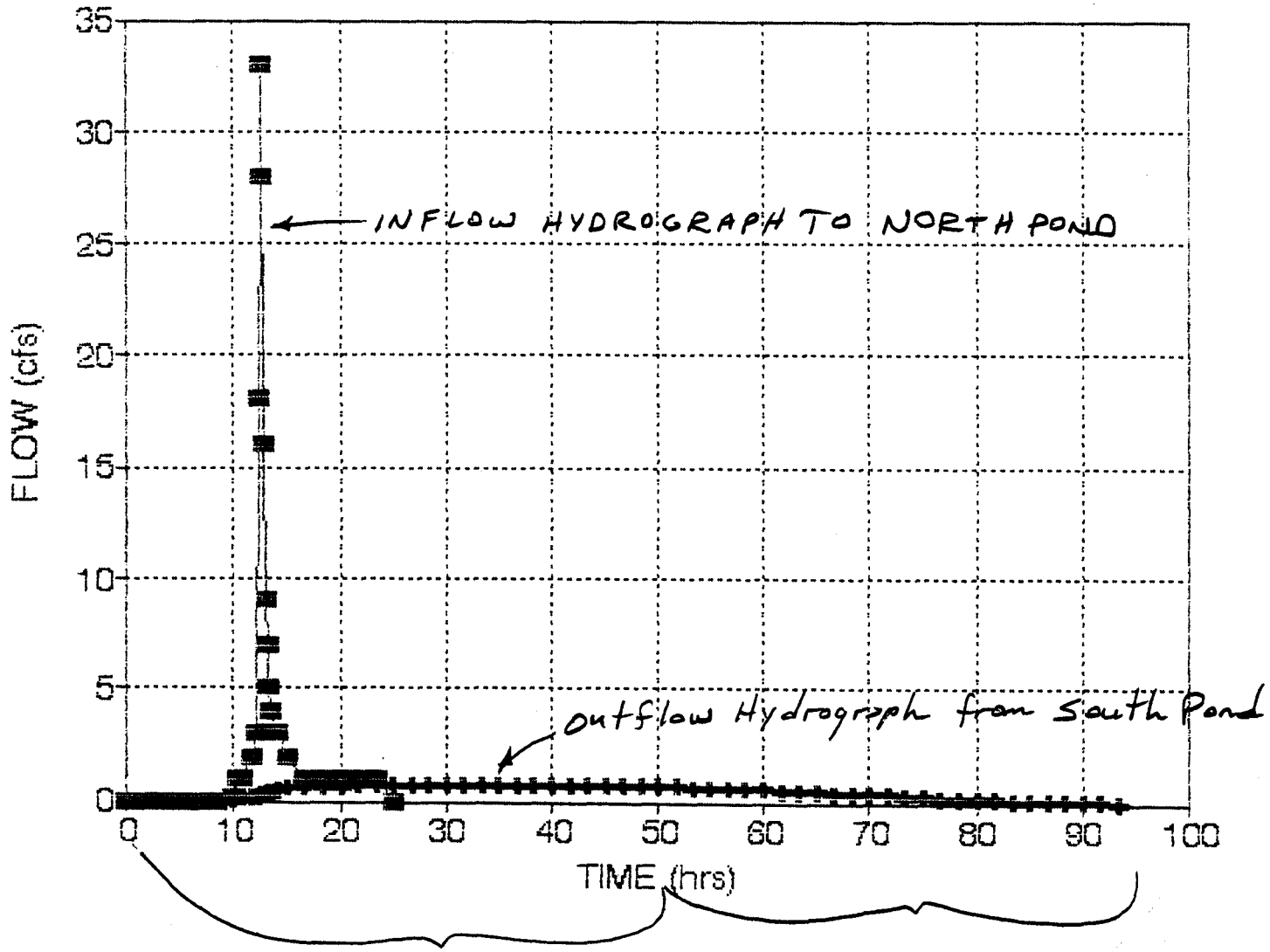
The centroid of the inflow hydrograph to the North Pond was found to occur at time step 76.3 (or 76.3 * 10 min interval / 60 min per hr = 12.7 hrs).

The centroid of the outflow hydrograph from the South Pond was found to occur at time step 244.3 (or 244.3 x 10 / 60 = 40.7 hrs)

The Detention Time is equal to the difference

or (244.3 − 76.3) * 10 minutes / 60 min = **28 hours**

Cottonwood/Wilbury Mine



SEE INITIAL HEC-1 RUN
INFLOW - pp. 9 and 10
Outflow - interpolated from graph on pp. 21-25

SEE EXTENSION HEC-1 RUN
OUTFLOW INTERPOLATED from graph on pp. 7-10

NOTE: HEC-1 Prints out hydrograph flow rates to the nearest cfs (e.g. 1. cfs for 0.7 cfs), for greater precision either use printout graphs or compute discharge based on computed STAGE.

NOTE: DATA for time steps 0 - 300 obtained from initial run, data for time steps 300 to 570 obtained from extension run.

UP&L
WILBURG MINE
10-YEAR 24-HR INFLOW TO NORTH POND VS OUTFLOW FROM SOUTH POND

STEP	TIME (HRS)	NORTH INFLOW (CFS)	DELTA VOL (cfs min.)	INFLOW ACCUM (cfs min.)	SOUTH OUTFLOW (CFS)	DELTA VOL (cfs min.)	OUTFLOW ACCUM (cfs min.)
0	0.00	0	0	0	0		0
10	1.67	0	0	0	0	0	0
20	3.33	0	0	0	0	0	0
30	5.00	0	0	0	0	0	0
40	6.67	0	0	0	0	0	0
50	8.33	0	0	0	0	0	0
60	10.00	0.1	10	10	0.05	5	5
62	10.33	1	20	30	0.07	1.4	6.4
65	10.83	1	30	60	0.09	2.7	9.1
71	11.83	2	120	180	0.1	6	15.1
73	12.17	3	60	240	0.13	2.6	17.7
74	12.33	18	180	420	0.16	1.6	19.3
75	12.50	28	280	700	0.19	1.9	21.2
76	12.67	33	330	1030	0.22	2.2	23.4
77	12.83	16	160	1190	0.26	2.6	26
78	13.00	9	90	1280	0.29	2.9	28.9
79	13.17	7	70	1350	0.32	3.2	32.1
80	13.33	5	50	1400	0.35	3.5	35.6
81	13.50	4	40	1440	0.4	4	39.6
85	14.17	3	120	1560	0.45	18	57.6
90	15.00	2	100	1660	0.5	25	82.6
100	16.67	1	100	1760	0.55	55	137.6
110	18.33	1	100	1860	0.6	60	197.6
120	20.00	1	100	1960	0.6	60	257.6
130	21.67	1	100	2060	0.65	65	322.6
140	23.33	1	100	2160	0.7	70	392.6
150	25.00	0	0	2160	0.7	70	462.6
160	26.67				0.7	70	532.6
170	28.33				0.7	70	602.6
180	30.00				0.7	70	672.6
190	31.67				0.7	70	742.6
200	33.33				0.7	70	812.6
210	35.00				0.7	70	882.6
220	36.67				0.7	70	952.6
230	38.33				0.7	70	1022.6
240	40.00				0.7	70	1092.6
250	41.67				0.7	70	1162.6
260	43.33				0.7	70	1232.6
270	45.00				0.7	70	1302.6
280	46.67				0.65	65	1367.6
290	48.33				0.65	65	1432.6
300	50.00				0.65	65	1497.6
310	51.67				0.62	62	1559.6
320	53.33				0.61	61	1620.6
330	55.00				0.6	60	1680.6
340	56.67				0.56	56	1736.6
350	58.33				0.53	53	1789.6

INFLOW CENTROID 76.3

half = 1080 cfs-minutes

outflow centroid 244.3

1122.8

360	60.00	0.51	51	1840.6
370	61.67	0.49	49	1889.6
380	63.33	0.46	46	1935.6
390	65.00	0.43	43	1978.6
400	66.67	0.41	41	2019.6
410	68.33	0.38	38	2057.6
420	70.00	0.35	35	2092.6
430	71.67	0.32	32	2124.6
440	73.33	0.29	29	2153.6
450	75.00	0.23	23	2176.6
460	76.67	0.18	18	2194.6
470	78.33	0.14	14	2208.6
480	80.00	0.11	11	2219.6
490	81.67	0.08	8	2227.6
500	83.33	0.06	6	2233.6
510	85.00	0.04	4	2237.6
520	86.67	0.03	3	2240.6
530	88.33	0.02	2	2242.6
540	90.00	0.02	2	2244.6
550	91.67	0.01	1	2245.6
560	93.33	0	0	2245.6
570	95.00			

half = 1122.8

INITIAL RUN

1

****
FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

10 yr 24-hr STORM

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1

South Pond modeled from beginning of storm (time = Ø) to time = 50 hours

HEC-1 INPUT

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID     UP&L Mining - Wilberg Mine Portal Facilities
            2           ID     10-YR 24-HR  SCS TYPE II DISTRIBUTION
            3           ID     by JAH Hansen, Allen & Luce  SEPT. 1991
*** FREE ***
                        *DIAGRAM
            4           IT      10       0       0     300
            5           IO       5

            6           KK    DA-1
            7           BA   .0088
            8           PB    2.40
            9           IN     30.
           10           PI      0.    .005    .006    .006    .006    .006    .006    .007    .007    .007
           11           PI    .008    .008    .009    .009     .01     .01     .01    .012    .015    .016
           12           PI    .018    .023   0.033    .046     .38    .072    .037    .027    .023    .018
           13           PI    .015    .013    .012    .011    .011     .01    .009    .009    .008    .008
           14           PI    .008    .008    .006    .006    .006    .005    .005    .005    .005
           15           LS       0    91.1      0.
           16           UD    .064

           17           KK    CD-1 ROUTE THROUGH CULVERT
           18           RK    100.     1.0    .015            CIRC       2

           19           KK   ROUTE ROUTE THROUGH SURFACE DITCH
           20           RK    340.     .02    .025            TRAP       1       2

           21           KK    DA-2
           22           BA  .00403
           23           LS       0      91       0
           24           UD    .067

           25           KK    CD-2 ROUTE THROUGH CULVERT
           26           RK    175.     .71    .015            CIRC     1.5

           27           KK   ROUTE ROUTE THROUGH SURFACE DITCH
           28           RK    260.     .02    .025            TRAP       1       2

           29           KK    DA-3
           30           BA   .0022
           31           LS       0      89       0
           32           UD    .065

           33           KK    CD-3 ROUTE THROUGH CULVERT
           34           RK     75.     .77    .015            CIRC     1.5

           35           KK   ROUTE ROUTE THROUGH SURFACE DITCH
           36           RK    400.     .02    .025            TRAP       1       2

           37           KK    DA-4
           38           BA   .0046
           39           LS       0      92       0
           40           UD     .05
```

1

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  41          KK    CD-4  COMBINE AT CULVERT CD-4
  42          HC       4

  43          KK    CD-4 ROUTE THROUGH CULVERT
  44          RK    154.     .19    .015            CIRC       2

  45          KK    DA-5
  46          BA  .00022
  47          LS       0       96       0
  48          UD     .05

  49          KK COMBINEAT CULVERT CD-5
  50          HC       2

  51          KK    CD-5 ROUTE THROUGH CULVERT
  52          RK     75.     .77    .015            CIRC       2

  53          KK    DA-6
  54          BA  .00648
  55          LS       0       82       0
  56          UD    .063

  57          KK COMBINEAT CULVERT CD-6
  58          HC       2

  59          KK    CD-6 ROUTE THROUGH CULVERT
  60          RK    140.     .36    .015            CIRC       2

  61          KK    DA-7
  62          BA  .00275
  63          LS       0       92       0
  64          UD    .059

  65          KK    DA-8
  66          BA  .00022
  67          LS       0       98       0
  68          UD     .05

  69          KK COMBINEAT CULVERT CD-8
  70          HC       2

  71          KK    CD-8 ROUTE THROUGH CULVERT
  72          RK    120.     .33    .015            CIRC    1.33

  73          KK COMBINEAT CULVERT CD-8
  74          HC       2

  75          KK    CD-8 ROUTE THROUGH CULVERT
  76          RK    160.     .03    .015            CIRC     2.5
```

1

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  77          KK    DA-9
  78          BA  .00389
  79          LS       0       89        0
  80          UD    .079

  81          KK COMBINEAT CULVERT CD-9
  82          HC       2

  83          KK    CD-9 ROUTE THROUGH CULVERT
  84          RK    120.      .33     .015            CIRC     2.5

  85          KK   DA-10
  86          BA  .00075
  87          LS       0       92        0
  88          UD     .05

  89          KK COMBINEAT CULVERT CD-10
  90          HC       2

  91          KK   CD-10 ROUTE THROUGH CULVERT
  92          RK    105.      .31     .015            CIRC     2.5

  93          KK   DA-11
  94          BA   .0019
  95          LS       0     92.8        0
  96          UD     .05

  97          KK COMBINEAT CULVERT CD-11
  98          HC       2

  99          KK   CD-11 ROUTE THROUGH CULVERT
 100          RK    300.     .066     .015            CIRC     2.5

 101          KK   DA-12
 102          BA  .00048
 103          LS       0       98        0
 104          UD    .065

 105          KK   CD-12 ROUTE THROUGH CULVERT
 106          RK     95.      .26     .015            CIRC     1.2

 107          KK   DA-13
 108          BA  .00016
 109          LS       0       98        0
 110          UD     .05

 111          KK   CD-13 ROUTE THROUGH CULVERT
 112          RK    100.      .06     .015            CIRC    1.33
```

1

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 113          KK   DA-14
 114          BA  .00113
 115          LS       0       92        0
 116          UD    .056

 117          KK   CD-14 ROUTE THROUGH CULVERT
 118          RK     60.      .16     .015             CIRC      1.2

 119          KK   DA-17
 120          BA  .00141
 121          LS       0     88.5        0
 122          UD    .107

 123          KK   NORTHCOMBINE AT NORTH POND
 124          KO       1
 125          HC       5

 126          KK    POND1
 127          KM
 128          KO       1        2
 129          RS       1     ELEV     56.5
 130          SV       0      .06      .14      .26      .44      .67      .95     1.29     1.69     2.14
 131          SV    2.66     2.92
 132          SE    46.0     48.0     50.0     52.0     54.0     56.0     58.0     60.0     62.0     64.0
 133          SE    66.0     67.0
 134          SQ       0      .46      .82     1.06     1.25     1.34     4.11     6.43    12.31    19.52
 135          SQ   23.56    32.43    41.48    45.32    54.07    63.97     69.3    80.63
 136          SE    56.5     58.0     60.0     62.0     64.0     65.0     65.2     65.3     65.5     65.7
 137          SE    65.8     66.0     66.2     66.3     65.5     66.7     66.8     67.0

 138          KK   DA-15
 139          BA  .00045
 140          LS       0       98        0
 141          UD     .05

 142          KK   CD-15 ROUTE THROUGH CULVERT
 143          RK     50.      .15     .015             CIRC        1

 144          KK   DA-16
 145          BA  .00031
 146          LS       0       98        0
 147          UD     .05

 148          KK   CD-16 ROUTE THROUGH CULVERT
 149          RK     40.      .15     .015             CIRC        1

 150          KK   DA-18
 151          BA  .00134
 152          LS       0       88        0
 153          UD    .062
```

1

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 154          KK   SOUTHCOMBINE AT SOUTH POND
 155          HC       4

 156          KK    POND2
 157          KM
 158          KO       1       2
 159          RS       1    ELEV    25.5
 160          SV       0     .03     .09     .19     .36     .58     .86    1.20    1.62    2.12
 161          SV    2.37
 162          SE    18.0    20.0    22.0    24.0    26.0    28.0    30.0    32.0    34.0    36.0
 163          SE    37.0
 164          SQ       0     .29     .44     .55     .65     .73     3.5    5.81   11.68    18.9
 165          SQ    22.9    31.8    40.0   43.29   50.84   59.32   63.65   72.78
 166          SE    25.5    27.0    29.0    31.0    33.0    35.0    35.2    35.3    35.5    35.7
 167          SE    35.8    36.0    36.2    36.3    36.5    36.7    36.8    37.0
 168          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6        DA-1
                V
                V
   17        CD-1
                V
                V
   19       ROUTE
                .
                .
   21           .        DA-2
                .           V
                .           V
   25           .        CD-2
                .           V
                .           V
   27           .       ROUTE
                .           .
                .           .
   29           .           .        DA-3
                .           .           V
                .           .           V
   33           .           .        CD-3
                .           .           V
                .           .           V
   35           .           .       ROUTE
                .           .           .
                .           .           .
   37           .           .           .        DA-4
                .           .           .           .
                .           .           .           .
   41        CD-4.......................................
                V
                V
   43        CD-4
                .
                .
   45           .        DA-5
                .           .
                .           .
   49     COMBINE............
                V
                V
   51        CD-5
                .
                .
   53           .        DA-6
                .           .
                .           .
   57     COMBINE............
                V
                V
   59        CD-6
                .
                .
   61           .        DA-7
                .           .
                .           .
   65           .           .        DA-8
                .           .           .
                .           .           .
   69           .     COMBINE............
                .           V
                .           V
   71           .        CD-8
                .           .
                .           .
   73     COMBINE............
                V
```

```
                V
 75          CD-8
                .
                .
 77             .          DA-9
                .            .
                .            .
 81       COMBINE............
                V
                V
 83          CD-9
                .
                .
 85             .         DA-10
                .            .
                .            .
 89       COMBINE............
                V
                V
 91         CD-10
                .
                .
 93             .         DA-11
                .            .
                .            .
 97       COMBINE............
                V
                V
 99         CD-11
                .
                .
101             .         DA-12
                .            V
                .            V
105             .         CD-12
                .            .
                .            .
107             .            .        DA-13
                .            .           V
                .            .           V
111             .            .        CD-13
                .            .           .
                .            .           .
113             .            .           .        DA-14
                .            .           .           V
                .            .           .           V
117             .            .           .        CD-14
                .            .           .           .
                .            .           .           .
119             .            .           .           .        DA-17
                .            .           .           .           .
                .            .           .           .           .
123        NORTH.............................................
                V
                V
126         POND
                .
                .
138             .         DA-15
                .            V
                .            V
142             .         CD-15
                .            .
                .            .
144             .            .        DA-16
                .            .           V
                .            .           V
148             .            .        CD-16
                .            .           .
                .            .           .
150             .            .           .        DA-18
                .            .           .           .
                .            .           .           .
154        SOUTH.................................
                V
```

```
                V
 156          POND

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
                                                                    ****
                          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
              U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                                    ****


                        UP&L Mining - Wilberg Mine Portal Facilities
                        10-YR 24-HR  SCS TYPE II DISTRIBUTION
                        by JAH Hansen, Allen & Luce  SEPT. 1991

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          10  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      3    0  ENDING DATE
                     NDTIME        0150  ENDING TIME

                 COMPUTATION INTERVAL     .17 HOURS
                      TOTAL TIME BASE   49.83 HOURS

         ENGLISH UNITS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 123 KK     *     NORTH  *      COMBINE AT NORTH POND
            *            *
            **************

 124 KO         OUTPUT CONTROL VARIABLES
                      IPRNT           1  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

 125 HC         HYDROGRAPH COMBINATION
                      ICOMP           5  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***
*****************************************************************************************************************************
                                          HYDROGRAPH AT STATION     NORTH
                                               SUM OF  5 HYDROGRAPHS
*****************************************************************************************************************************
                                 *                                 *                                 *
  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW
                                 *  (columns continued from p.10) *  (columns continued from p.10) *  (columns continued from p.10)
   1     0000    1        0.     *   1     1230   76       33.     *   2     0100  151        0.     *   2     1330  226        0.
   1     0010    2        0.     *   1     1240   77       16.     *   2     0110  152        0.     *   2     1340  227        0.
   1     0020    3        0.     *   1     1250   78        9.     *   2     0120  153        0.     *   2     1350  228        0.
   1     0030    4        0.     *   1     1300   79        7.     *   2     0130  154        0.     *   2     1400  229        0.
   1     0040    5        0.     *   1     1310   80        5.     *   2     0140  155        0.     *   2     1410  230        0.
   1     0050    6        0.     *   1     1320   81        4.     *   2     0150  156        0.     *   2     1420  231        0.
   1     0100    7        0.     *   1     1330   82        4.     *   2     0200  157        0.     *   2     1430  232        0.
   1     0110    8        0.     *   1     1340   83        3.     *   2     0210  158        0.     *   2     1440  233        0.
   1     0120    9        0.     *   1     1350   84        3.     *   2     0220  159        0.     *   2     1450  234        0.
   1     0130   10        0.     *   1     1400   85        3.     *   2     0230  160        0.     *   2     1500  235        0.
 (columns continued on next page)  (columns continued on next page) (columns continued on next page)  (columns continued on next page)
```

DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0140	11	0.	*	1		1410	86	2.	*	2		0240	161	0.	*	2		1510	236	0.
1		0150	12	0.	*	1		1420	87	2.	*	2		0250	162	0.	*	2		1520	237	0.
1		0200	13	0.	*	1		1430	88	2.	*	2		0300	163	0.	*	2		1530	238	0.
1		0210	14	0.	*	1		1440	89	2.	*	2		0310	164	0.	*	2		1540	239	0.
1		0220	15	0.	*	1		1450	90	2.	*	2		0320	165	0.	*	2		1550	240	0.
1		0230	16	0.	*	1		1500	91	2.	*	2		0330	166	0.	*	2		1600	241	0.
1		0240	17	0.	*	1		1510	92	2.	*	2		0340	167	0.	*	2		1610	242	0.
1		0250	18	0.	*	1		1520	93	2.	*	2		0350	168	0.	*	2		1620	243	0.
1		0300	19	0.	*	1		1530	94	2.	*	2		0400	169	0.	*	2		1630	244	0.
1		0310	20	0.	*	1		1540	95	1.	*	2		0410	170	0.	*	2		1640	245	0.
1		0320	21	0.	*	1		1550	96	1.	*	2		0420	171	0.	*	2		1650	246	0.
1		0330	22	0.	*	1		1600	97	1.	*	2		0430	172	0.	*	2		1700	247	0.
1		0340	23	0.	*	1		1610	98	1.	*	2		0440	173	0.	*	2		1710	248	0.
1		0350	24	0.	*	1		1620	99	1.	*	2		0450	174	0.	*	2		1720	249	0.
1		0400	25	0.	*	1		1630	100	1.	*	2		0500	175	0.	*	2		1730	250	0.
1		0410	26	0.	*	1		1640	101	1.	*	2		0510	176	0.	*	2		1740	251	0.
1		0420	27	0.	*	1		1650	102	1.	*	2		0520	177	0.	*	2		1750	252	0.
1		0430	28	0.	*	1		1700	103	1.	*	2		0530	178	0.	*	2		1800	253	0.
1		0440	29	0.	*	1		1710	104	1.	*	2		0540	179	0.	*	2		1810	254	0.
1		0450	30	0.	*	1		1720	105	1.	*	2		0550	180	0.	*	2		1820	255	0.
1		0500	31	0.	*	1		1730	106	1.	*	2		0600	181	0.	*	2		1830	256	0.
1		0510	32	0.	*	1		1740	107	1.	*	2		0610	182	0.	*	2		1840	257	0.
1		0520	33	0.	*	1		1750	108	1.	*	2		0620	183	0.	*	2		1850	258	0.
1		0530	34	0.	*	1		1800	109	1.	*	2		0630	184	0.	*	2		1900	259	0.
1		0540	35	0.	*	1		1810	110	1.	*	2		0640	185	0.	*	2		1910	260	0.
1		0550	36	0.	*	1		1820	111	1.	*	2		0650	186	0.	*	2		1920	261	0.
1		0600	37	0.	*	1		1830	112	1.	*	2		0700	187	0.	*	2		1930	262	0.
1		0610	38	0.	*	1		1840	113	1.	*	2		0710	188	0.	*	2		1940	263	0.
1		0620	39	0.	*	1		1850	114	1.	*	2		0720	189	0.	*	2		1950	264	0.
1		0630	40	0.	*	1		1900	115	1.	*	2		0730	190	0.	*	2		2000	265	0.
1		0640	41	0.	*	1		1910	116	1.	*	2		0740	191	0.	*	2		2010	266	0.
1		0650	42	0.	*	1		1920	117	1.	*	2		0750	192	0.	*	2		2020	267	0.
1		0700	43	0.	*	1		1930	118	1.	*	2		0800	193	0.	*	2		2030	268	0.
1		0710	44	0.	*	1		1940	119	1.	*	2		0810	194	0.	*	2		2040	269	0.
1		0720	45	0.	*	1		1950	120	1.	*	2		0820	195	0.	*	2		2050	270	0.
1		0730	46	0.	*	1		2000	121	1.	*	2		0830	196	0.	*	2		2100	271	0.
1		0740	47	0.	*	1		2010	122	1.	*	2		0840	197	0.	*	2		2110	272	0.
1		0750	48	0.	*	1		2020	123	1.	*	2		0850	198	0.	*	2		2120	273	0.
1		0800	49	0.	*	1		2030	124	1.	*	2		0900	199	0.	*	2		2130	274	0.
1		0810	50	0.	*	1		2040	125	1.	*	2		0910	200	0.	*	2		2140	275	0.
1		0820	51	0.	*	1		2050	126	1.	*	2		0920	201	0.	*	2		2150	276	0.
1		0830	52	0.	*	1		2100	127	1.	*	2		0930	202	0.	*	2		2200	277	0.
1		0840	53	0.	*	1		2110	128	1.	*	2		0940	203	0.	*	2		2210	278	0.
1		0850	54	0.	*	1		2120	129	1.	*	2		0950	204	0.	*	2		2220	279	0.
1		0900	55	0.	*	1		2130	130	1.	*	2		1000	205	0.	*	2		2230	280	0.
1		0910	56	0.	*	1		2140	131	1.	*	2		1010	206	0.	*	2		2240	281	0.
1		0920	57	0.	*	1		2150	132	1.	*	2		1020	207	0.	*	2		2250	282	0.
1		0930	58	0.	*	1		2200	133	1.	*	2		1030	208	0.	*	2		2300	283	0.
1		0940	59	0.	*	1		2210	134	1.	*	2		1040	209	0.	*	2		2310	284	0.
1		0950	60	0.	*	1		2220	135	1.	*	2		1050	210	0.	*	2		2320	285	0.
1		1000	61	0.	*	1		2230	136	1.	*	2		1100	211	0.	*	2		2330	286	0.
1		1010	62	1.	*	1		2240	137	1.	*	2		1110	212	0.	*	2		2340	287	0.
1		1020	63	1.	*	1		2250	138	1.	*	2		1120	213	0.	*	2		2350	288	0.
1		1030	64	1.	*	1		2300	139	1.	*	2		1130	214	0.	*	3		0000	289	0.
1		1040	65	1.	*	1		2310	140	1.	*	2		1140	215	0.	*	3		0010	290	0.
1		1050	66	1.	*	1		2320	141	1.	*	2		1150	216	0.	*	3		0020	291	0.
1		1100	67	1.	*	1		2330	142	1.	*	2		1200	217	0.	*	3		0030	292	0.
1		1110	68	1.	*	1		2340	143	1.	*	2		1210	218	0.	*	3		0040	293	0.
1		1120	69	1.	*	1		2350	144	1.	*	2		1220	219	0.	*	3		0050	294	0.
1		1130	70	2.	*	2		0000	145	1.	*	2		1230	220	0.	*	3		0100	295	0.
1		1140	71	2.	*	2		0010	146	1.	*	2		1240	221	0.	*	3		0110	296	0.
1		1150	72	2.	*	2		0020	147	1.	*	2		1250	222	0.	*	3		0120	297	0.
1		1200	73	3.	*	2		0030	148	1.	*	2		1300	223	0.	*	3		0130	298	0.
1		1210	74	18.	*	2		0040	149	0.	*	2		1310	224	0.	*	3		0140	299	0.
1		1220	75	28.	*	2		0050	150	0.	*	2		1320	225	0.	*	3		0150	300	0.

(columns continued on p. 9) * (columns continued on P. 9) * (columns continued on p. 9) *

****

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	49.83-HR
+ (CFS)	(HR)				
		(CFS)			

```
+      33.     12.50                    5.         2.         1.         1.
                          (INCHES)   1.148      1.438      1.438      1.438
                           (AC-FT)      2.         3.         3.         3.

                          CUMULATIVE AREA =     .04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
 126 KK       *     POND   *     1
              *            *
              **************

 128 KO            OUTPUT CONTROL VARIABLES
                        IPRNT          1  PRINT CONTROL
                        IPLOT          2  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

                 HYDROGRAPH ROUTING DATA

 129 RS            STORAGE ROUTING
                        NSTPS          1  NUMBER OF SUBREACHES
                         ITYP       ELEV  TYPE OF INITIAL CONDITION
                       RSVRIC      56.50  INITIAL CONDITION
                            X        .00 WORKING R AND D COEFFICIENT

 130 SV              STORAGE         .0        .1        .1        .3        .4        .7        .9       1.3       1.7       2.1
                                    2.7       2.9

 132 SE            ELEVATION      46.00     48.00     50.00     52.00     54.00     56.00     58.00     60.00     62.00     64.00
                                  66.00     67.00

 134 SQ            DISCHARGE         0.        0.        1.        1.        1.        1.        4.        6.       12.       20.
                                    24.       32.       41.       45.       54.       64.       69.       81.

 136 SE            ELEVATION      56.50     58.00     60.00     62.00     64.00     65.00     65.20     65.30     65.50     65.70
                                  65.80     66.00     66.20     66.30     66.50     66.70     66.80     67.00
                                                                   ***

                                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

            STORAGE        .00       .06       .14       .26       .44       .67       .74       .95      1.29      1.69
            OUTFLOW        .00       .00       .00       .00       .00       .00       .00       .46       .82      1.06
          ELEVATION      46.00     48.00     50.00     52.00     54.00     56.00     56.50     58.00     60.00     62.00

            STORAGE       2.14      2.40      2.45      2.48      2.53      2.58      2.61      2.66      2.71      2.74
            OUTFLOW       1.25      1.34      4.11      6.43     12.31     19.52     23.56     32.43     41.48     45.32
          ELEVATION      64.00     65.00     65.20     65.30     65.50     65.70     65.80     66.00     66.20     66.30

            STORAGE       2.79      2.84      2.87      2.92
            OUTFLOW      54.07     63.97     69.30     80.63
          ELEVATION      66.50     66.70     66.80     67.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN       20. TO       81.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

*************************************************************************************************************************************

                                                HYDROGRAPH AT STATION     POND

*************************************************************************************************************************************
                                          *                                          *
 DA MON HRMN ORD  OUTFLOW  STORAGE   STAGE * DA MON HRMN ORD  OUTFLOW  STORAGE   STAGE * DA MON HRMN ORD  OUTFLOW  STORAGE   STAGE
        *                                 * (columns continued from p.10)            *  (columns continued from p.10)
  1     0000   1       0.       .7    56.5 * 1     1640 101       1.       2.4    65.0 * 2     0920 201       1.       1.3    60.2
  1     0010   2       0.       .7    56.5 * 1     1650 102       1.       2.4    65.0 * 2     0930 202       1.       1.3    60.1
  1     0020   3       0.       .7    56.5 * 1     1700 103       1.       2.4    65.0 * 2     0940 203       1.       1.3    60.0
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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0030	4	0.	.7	56.5	*	1		1710	104	1.	2.4	65.0	*	2		0950	204	1.	1.3	60.0
1		0040	5	0.	.7	56.5	*	1		1720	105	1.	2.4	64.9	*	2		1000	205	1.	1.3	59.9
1		0050	6	0.	.7	56.5	*	1		1730	106	1.	2.4	64.9	*	2		1010	206	1.	1.3	59.9
1		0100	7	0.	.7	56.5	*	1		1740	107	1.	2.4	64.9	*	2		1020	207	1.	1.3	59.8
1		0110	8	0.	.7	56.5	*	1		1750	108	1.	2.4	64.9	*	2		1030	208	1.	1.2	59.7
1		0120	9	0.	.7	56.5	*	1		1800	109	1.	2.4	64.9	*	2		1040	209	1.	1.2	59.7
1		0130	10	0.	.7	56.5	*	1		1810	110	1.	2.4	64.9	*	2		1050	210	1.	1.2	59.6
1		0140	11	0.	.7	56.5	*	1		1820	111	1.	2.4	64.9	*	2		1100	211	1.	1.2	59.5
1		0150	12	0.	.7	56.5	*	1		1830	112	1.	2.4	64.8	*	2		1110	212	1.	1.2	59.5
1		0200	13	0.	.7	56.5	*	1		1840	113	1.	2.4	64.8	*	2		1120	213	1.	1.2	59.4
1		0210	14	0.	.7	56.5	*	1		1850	114	1.	2.3	64.8	*	2		1130	214	1.	1.2	59.4
1		0220	15	0.	.7	56.5	*	1		1900	115	1.	2.3	64.8	*	2		1140	215	1.	1.2	59.3
1		0230	16	0.	.7	56.5	*	1		1910	116	1.	2.3	64.7	*	2		1150	216	1.	1.2	59.3
1		0240	17	0.	.7	56.5	*	1		1920	117	1.	2.3	64.7	*	2		1200	217	1.	1.2	59.2
1		0250	18	0.	.7	56.5	*	1		1930	118	1.	2.3	64.7	*	2		1210	218	1.	1.1	59.1
1		0300	19	0.	.7	56.5	*	1		1940	119	1.	2.3	64.7	*	2		1220	219	1.	1.1	59.1
1		0310	20	0.	.7	56.5	*	1		1950	120	1.	2.3	64.6	*	2		1230	220	1.	1.1	59.0
1		0320	21	0.	.7	56.5	*	1		2000	121	1.	2.3	64.6	*	2		1240	221	1.	1.1	59.0
1		0330	22	0.	.7	56.5	*	1		2010	122	1.	2.3	64.6	*	2		1250	222	1.	1.1	58.9
1		0340	23	0.	.7	56.5	*	1		2020	123	1.	2.3	64.6	*	2		1300	223	1.	1.1	58.9
1		0350	24	0.	.7	56.5	*	1		2030	124	1.	2.3	64.6	*	2		1310	224	1.	1.1	58.8
1		0400	25	0.	.7	56.5	*	1		2040	125	1.	2.3	64.5	*	2		1320	225	1.	1.1	58.8
1		0410	26	0.	.7	56.5	*	1		2050	126	1.	2.3	64.5	*	2		1330	226	1.	1.1	58.7
1		0420	27	0.	.7	56.5	*	1		2100	127	1.	2.3	64.5	*	2		1340	227	1.	1.1	58.7
1		0430	28	0.	.7	56.5	*	1		2110	128	1.	2.3	64.5	*	2		1350	228	1.	1.1	58.6
1		0440	29	0.	.7	56.5	*	1		2120	129	1.	2.2	64.4	*	2		1400	229	1.	1.1	58.6
1		0450	30	0.	.7	56.5	*	1		2130	130	1.	2.2	64.4	*	2		1410	230	1.	1.0	58.6
1		0500	31	0.	.7	56.5	*	1		2140	131	1.	2.2	64.3	*	2		1420	231	1.	1.0	58.5
1		0510	32	0.	.7	56.5	*	1		2150	132	1.	2.2	64.3	*	2		1430	232	1.	1.0	58.5
1		0520	33	0.	.7	56.5	*	1		2200	133	1.	2.2	64.3	*	2		1440	233	1.	1.0	58.4
1		0530	34	0.	.7	56.5	*	1		2210	134	1.	2.2	64.2	*	2		1450	234	1.	1.0	58.4
1		0540	35	0.	.7	56.5	*	1		2220	135	1.	2.2	64.2	*	2		1500	235	1.	1.0	58.3
1		0550	36	0.	.7	56.5	*	1		2230	136	1.	2.2	64.2	*	2		1510	236	1.	1.0	58.3
1		0600	37	0.	.7	56.5	*	1		2240	137	1.	2.2	64.1	*	2		1520	237	1.	1.0	58.3
1		0610	38	0.	.7	56.5	*	1		2250	138	1.	2.2	64.1	*	2		1530	238	0.	1.0	58.2
1		0620	39	0.	.7	56.5	*	1		2300	139	1.	2.2	64.1	*	2		1540	239	0.	1.0	58.2
1		0630	40	0.	.7	56.5	*	1		2310	140	1.	2.1	64.0	*	2		1550	240	0.	1.0	58.1
1		0640	41	0.	.7	56.5	*	1		2320	141	1.	2.1	64.0	*	2		1600	241	0.	1.0	58.1
1		0650	42	0.	.7	56.5	*	1		2330	142	1.	2.1	63.9	*	2		1610	242	0.	1.0	58.1
1		0700	43	0.	.7	56.5	*	1		2340	143	1.	2.1	63.9	*	2		1620	243	0.	1.0	58.0
1		0710	44	0.	.7	56.5	*	1		2350	144	1.	2.1	63.9	*	2		1630	244	0.	.9	58.0
1		0720	45	0.	.7	56.5	*	2		0000	145	1.	2.1	63.8	*	2		1640	245	0.	.9	57.9
1		0730	46	0.	.7	56.5	*	2		0010	146	1.	2.1	63.8	*	2		1650	246	0.	.9	57.9
1		0740	47	0.	.7	56.6	*	2		0020	147	1.	2.1	63.7	*	2		1700	247	0.	.9	57.8
1		0750	48	0.	.7	56.6	*	2		0030	148	1.	2.1	63.7	*	2		1710	248	0.	.9	57.8
1		0800	49	0.	.8	56.6	*	2		0040	149	1.	2.1	63.6	*	2		1720	249	0.	.9	57.8
1		0810	50	0.	.8	56.6	*	2		0050	150	1.	2.0	63.6	*	2		1730	250	0.	.9	57.7
1		0820	51	0.	.8	56.6	*	2		0100	151	1.	2.0	63.5	*	2		1740	251	0.	.9	57.7
1		0830	52	0.	.8	56.6	*	2		0110	152	1.	2.0	63.4	*	2		1750	252	0.	.9	57.7
1		0840	53	0.	.8	56.6	*	2		0120	153	1.	2.0	63.4	*	2		1800	253	0.	.9	57.6
1		0850	54	0.	.8	56.6	*	2		0130	154	1.	2.0	63.3	*	2		1810	254	0.	.9	57.6
1		0900	55	0.	.8	56.7	*	2		0140	155	1.	2.0	63.2	*	2		1820	255	0.	.9	57.6
1		0910	56	0.	.8	56.7	*	2		0150	156	1.	1.9	63.1	*	2		1830	256	0.	.9	57.5
1		0920	57	0.	.8	56.7	*	2		0200	157	1.	1.9	63.1	*	2		1840	257	0.	.9	57.5
1		0930	58	0.	.8	56.7	*	2		0210	158	1.	1.9	63.0	*	2		1850	258	0.	.9	57.5
1		0940	59	0.	.8	56.8	*	2		0220	159	1.	1.9	62.9	*	2		1900	259	0.	.9	57.4
1		0950	60	0.	.8	56.8	*	2		0230	160	1.	1.9	62.9	*	2		1910	260	0.	.9	57.4
1		1000	61	0.	.8	56.8	*	2		0240	161	1.	1.9	62.8	*	2		1920	261	0.	.9	57.4
1		1010	62	0.	.8	56.9	*	2		0250	162	1.	1.9	62.7	*	2		1930	262	0.	.9	57.4
1		1020	63	0.	.8	56.9	*	2		0300	163	1.	1.8	62.6	*	2		1940	263	0.	.9	57.3
1		1030	64	0.	.8	57.0	*	2		0310	164	1.	1.8	62.6	*	2		1950	264	0.	.9	57.3
1		1040	65	0.	.8	57.0	*	2		0320	165	1.	1.8	62.5	*	2		2000	265	0.	.8	57.3
1		1050	66	0.	.8	57.1	*	2		0330	166	1.	1.8	62.4	*	2		2010	266	0.	.8	57.3
1		1100	67	0.	.8	57.2	*	2		0340	167	1.	1.8	62.4	*	2		2020	267	0.	.8	57.2
1		1110	68	0.	.8	57.2	*	2		0350	168	1.	1.8	62.3	*	2		2030	268	0.	.8	57.2
1		1120	69	0.	.9	57.4	*	2		0400	169	1.	1.7	62.2	*	2		2040	269	0.	.8	57.2
1		1130	70	0.	.9	57.5	*	2		0410	170	1.	1.7	62.2	*	2		2050	270	0.	.8	57.2
1		1140	71	0.	.9	57.6	*	2		0420	171	1.	1.7	62.1	*	2		2100	271	0.	.8	57.2
1		1150	72	0.	.9	57.8	*	2		0430	172	1.	1.7	62.0	*	2		2110	272	0.	.8	57.1
1		1200	73	0.	1.0	58.0	*	2		0440	173	1.	1.7	62.0	*	2		2120	273	0.	.8	57.1
1		1210	74	1.	1.1	58.8	*	2		0450	174	1.	1.7	61.9	*	2		2130	274	0.	.8	57.1
1		1220	75	1.	1.4	60.6	*	2		0500	175	1.	1.7	61.8	*	2		2140	275	0.	.8	57.1

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		1230	76	1.	1.8	62.5	*	2		0510	176	1.	1.6	61.8	*	2		2150	276	0.	.8	57.1
1		1240	77	1.	2.1	64.0	*	2		0520	177	1.	1.6	61.7	*	2		2200	277	0.	.8	57.0
1		1250	78	1.	2.3	64.6	*	2		0530	178	1.	1.6	61.6	*	2		2210	278	0.	.8	57.0
1		1300	79	1.	2.4	64.9	*	2		0540	179	1.	1.6	61.6	*	2		2220	279	0.	.8	57.0
1		1310	80	3.	2.4	65.1	*	2		0550	180	1.	1.6	61.5	*	2		2230	280	0.	.8	57.0
1		1320	81	4.	2.4	65.2	*	2		0600	181	1.	1.6	61.4	*	2		2240	281	0.	.8	57.0
1		1330	82	4.	2.4	65.2	*	2		0610	182	1.	1.6	61.3	*	2		2250	282	0.	.8	57.0
1		1340	83	4.	2.4	65.2	*	2		0620	183	1.	1.5	61.3	*	2		2300	283	0.	.8	57.0
1		1350	84	3.	2.4	65.1	*	2		0630	184	1.	1.5	61.2	*	2		2310	284	0.	.8	56.9
1		1400	85	3.	2.4	65.1	*	2		0640	185	1.	1.5	61.1	*	2		2320	285	0.	.8	56.9
1		1410	86	3.	2.4	65.1	*	2		0650	186	1.	1.5	61.1	*	2		2330	286	0.	.8	56.9
1		1420	87	3.	2.4	65.1	*	2		0700	187	1.	1.5	61.0	*	2		2340	287	0.	.8	56.9
1		1430	88	2.	2.4	65.1	*	2		0710	188	1.	1.5	61.0	*	2		2350	288	0.	.8	56.9
1		1440	89	2.	2.4	65.1	*	2		0720	189	1.	1.5	60.9	*	3		0000	289	0.	.8	56.9
1		1450	90	2.	2.4	65.1	*	2		0730	190	1.	1.5	60.8	*	3		0010	290	0.	.8	56.9
1		1500	91	2.	2.4	65.0	*	2		0740	191	1.	1.4	60.8	*	3		0020	291	0.	.8	56.9
1		1510	92	2.	2.4	65.0	*	2		0750	192	1.	1.4	60.7	*	3		0030	292	0.	.8	56.8
1		1520	93	2.	2.4	65.0	*	2		0800	193	1.	1.4	60.6	*	3		0040	293	0.	.8	56.8
1		1530	94	2.	2.4	65.0	*	2		0810	194	1.	1.4	60.6	*	3		0050	294	0.	.8	56.8
1		1540	95	2.	2.4	65.0	*	2		0820	195	1.	1.4	60.5	*	3		0100	295	0.	.8	56.8
1		1550	96	1.	2.4	65.0	*	2		0830	196	1.	1.4	60.5	*	3		0110	296	0.	.8	56.8
1		1600	97	1.	2.4	65.0	*	2		0840	197	1.	1.4	60.4	*	3		0120	297	0.	.8	56.8
1		1610	98	1.	2.4	65.0	*	2		0850	198	1.	1.4	60.3	*	3		0130	298	0.	.8	56.8
1		1620	99	1.	2.4	65.0	*	2		0900	199	1.	1.3	60.3	*	3		0140	299	0.	.8	56.8
1		1630	100	1.	2.4	65.0	*	2		0910	200	1.	1.3	60.2	*	3		0150	300	0.	.8	56.8

(columns continued on p. 11) * (columns continued on P. 11) *

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	49.83-HR
+ (CFS)	(HR)					
		(CFS)				
+ 4.	13.50		2.	1.	1.	1.
		(INCHES)	.452	1.216	1.419	1.419
		(AC-FT)	1.	3.	3.	3.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	49.83-HR
+ (AC-FT)	(HR)				
2.	13.33	2.	2.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	49.83-HR
+ (FEET)	(HR)				
65.18	13.50	65.00	62.98	59.97	59.97

CUMULATIVE AREA = .04 SQ MI

1

STATION POND

(I) INFLOW, (O) OUTFLOW

(S) STORAGE

DAHRMN	PER	0.	4.	8.	12.	16.	20.	24.	28.	32.	36.	0.	0.	0.
		.0	.0	.0	.0	.0	.0	.5	1.0	1.5	2.0	2.5	.0	.0
10000	1I								S					
10010	2I								S					
10020	3I								S					
10030	4I								S					
10040	5I								S					
10050	6I								S					
10100	7I								S					
10110	8I								S					
10120	9I								S					
10130	10I								S					
10140	11I								S					
10150	12I								S					
10200	13I								S					
10210	14I								S					
10220	15I								S					
10230	16I								S					
10240	17I								S					
10250	18I								S					
10300	19I								S					
10310	20I								S					
10320	21I								S					
10330	22I								S					
10340	23I								S					
10350	24I								S					
10400	25I								S					
10410	26I								S					
10420	27I								S					
10430	28I								S					
10440	29I								S					
10450	30I								S					
10500	31I								S					
10510	32I								S					
10520	33I								S					
10530	34I								S					
10540	35I								S					
10550	36I								S					
10600	37I								S					
10610	38I								S					
10620	39I								S					
10630	40I								S					
10640	41I								S					
10650	42I								S					
10700	43I								S					
10710	44I								S					
10720	45I								S					
10730	46I								S					
10740	47I								S					
10750	48I								S					
10800	49I								S					
10810	50I								S					
10820	51I								S					
10830	52I								S					
10840	53OI								S					
10850	54OI								S					
10900	55OI								S					
10910	56OI								S					
10920	57OI								S					
10930	58OI								S					
10940	59OI								S					
10950	60OI								S					
11000	61OI								S					
11010	62OI								S					
11020	63OI								S					
11030	640 I								S					
11040	650 I								S					
11050	660 I								S					
11100	67.OI								S					
11110	68.O I								S					

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11120  69.O  I
11130  70.O  I
11140  71.O. .I.
11150  72.O    I
11200  73.O     I
11210  74. O
11220  75. O
11230  76.  O
11240  77.  O
11250  78.  O
11300  79.  O
11310  80.       O . I
11320  81.           I
11330  82.          IO
11340  83.         IO.
11350  84.        IO
11400  85.        I
11410  86.       IO
11420  87.       I
11430  88.       I
11440  89.      IO
11450  90.      I
11500  91.  .   I.
11510  92.     IO
11520  93.     I
11530  94.     I
11540  95.     I
11550  96.    IO
11600  97.    I
11610  98.    I
11620  99.    I
11630 100.    I
11640 101.   .I.
11650 102.    I
11700 103.    I
11710 104.    I
11720 105.    I
11730 106.    I
11740 107.    I
11750 108.    I
11800 109.    I
11810 110.   IO
11820 111.   IO.
11830 112.   IO
11840 113.   IO
11850 114.   IO
11900 115.   IO
11910 116.   IO
11920 117.   IO
11930 118.   IO
11940 119.   IO
11950 120.   IO
12000 121.   IO.
12010 122.   IO
12020 123.   IO
12030 124.   IO
12040 125.   IO
12050 126.   IO
12100 127.   IO
12110 128.   IO
12120 129.   IO
12130 130.   IO
12140 131.   IO.
12150 132.   IO
12200 133.   IO
12210 134.   IO
12220 135.   IO
12230 136.   IO
12240 137.I  O
12250 138.I  O
12300 139.I  O
12310 140.I  O
12320 141.I.O.
12330 142.I  O
12340 143.I  O
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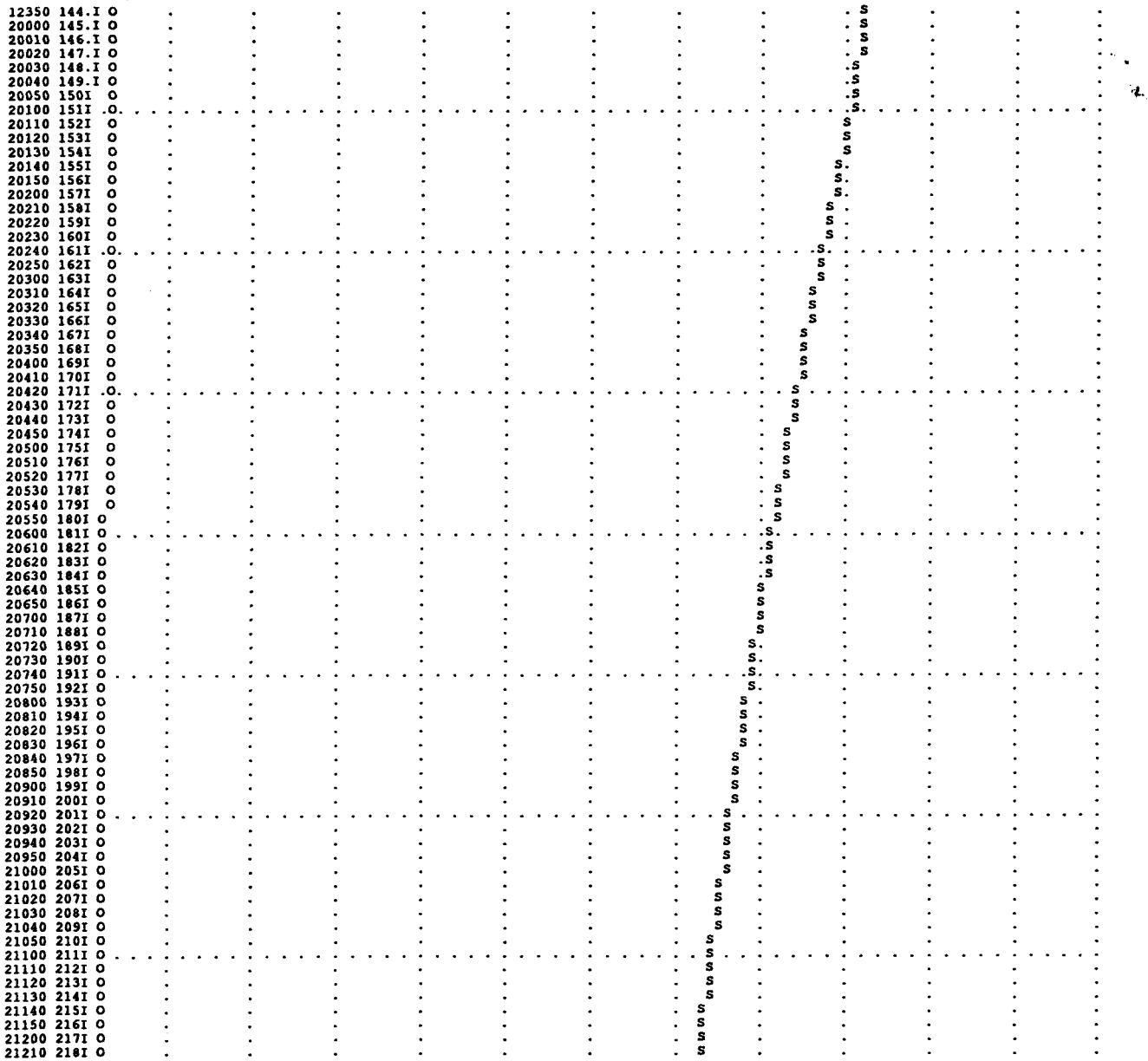
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20000 145.I O
20010 146.I O
20020 147.I O
20030 148.I O
20040 149.I O
20050 150I O
20100 151I .O.
20110 152I O
20120 153I O
20130 154I O
20140 155I O
20150 156I O
20200 157I O
20210 158I O
20220 159I O
20230 160I O
20240 161I .O.
20250 162I O
20300 163I O
20310 164I O
20320 165I O
20330 166I O
20340 167I O
20350 168I O
20400 169I O
20410 170I O
20420 171I .O.
20430 172I O
20440 173I O
20450 174I O
20500 175I O
20510 176I O
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20600 181I O
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20810 194I O
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20930 202I O
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21000 205I O
21010 206I O
21020 207I O
21030 208I O
21040 209I O
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21110 212I O
21120 213I O
21130 214I O
21140 215I O
21150 216I O
21200 217I O
21210 218I O

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21220 219I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21230 220I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21240 221I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21250 222I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21300 223I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21310 224I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21320 225I O        .         .         .         .         .         .         .  S      .         .         .         .         .
21330 226IO         .         .         .         .         .         .         .  S      .         .         .         .         .
21340 227IO         .         .         .         .         .         .         .S        .         .         .         .         .
21350 228IO         .         .         .         .         .         .         .S        .         .         .         .         .
21400 229IO         .         .         .         .         .         .         .S        .         .         .         .         .
21410 230IO         .         .         .         .         .         .         .S        .         .         .         .         .
21420 231IO         .         .         .         .         .         .         .S        .         .         .         .         .
21430 232IO         .         .         .         .         .         .         .S        .         .         .         .         .
21440 233IO         .         .         .         .         .         .         S         .         .         .         .         .
21450 234IO         .         .         .         .         .         .         S         .         .         .         .         .
21500 235IO         .         .         .         .         .         .         S         .         .         .         .         .
21510 236IO         .         .         .         .         .         .         S         .         .         .         .         .
21520 237IO         .         .         .         .         .         .         S         .         .         .         .         .
21530 238IO         .         .         .         .         .         .         S         .         .         .         .         .
21540 239IO         .         .         .         .         .         .         S         .         .         .         .         .
21550 240IO         .         .         .         .         .         .        S.         .         .         .         .         .
21600 241IO         .         .         .         .         .         .        S.         .         .         .         .         .
21610 242IO         .         .         .         .         .         .        S.         .         .         .         .         .
21620 243IO         .         .         .         .         .         .        S.         .         .         .         .         .
21630 244IO         .         .         .         .         .         .        S.         .         .         .         .         .
21640 245IO         .         .         .         .         .         .        S.         .         .         .         .         .
21650 246IO         .         .         .         .         .         .        S.         .         .         .         .         .
21700 247IO         .         .         .         .         .         .        S.         .         .         .         .         .
21710 248IO         .         .         .         .         .         .       S .         .         .         .         .         .
21720 249IO         .         .         .         .         .         .       S .         .         .         .         .         .
21730 250IO         .         .         .         .         .         .       S .         .         .         .         .         .
21740 251IO         .         .         .         .         .         .       S .         .         .         .         .         .
21750 252IO         .         .         .         .         .         .       S .         .         .         .         .         .
21800 253IO         .         .         .         .         .         .       S .         .         .         .         .         .
21810 254IO         .         .         .         .         .         .       S .         .         .         .         .         .
21820 255IO         .         .         .         .         .         .       S .         .         .         .         .         .
21830 256IO         .         .         .         .         .         .       S .         .         .         .         .         .
21840 257IO         .         .         .         .         .         .       S .         .         .         .         .         .
21850 258IO         .         .         .         .         .         .       S .         .         .         .         .         .
21900 259IO         .         .         .         .         .         .      S  .         .         .         .         .         .
21910 260IO         .         .         .         .         .         .      S  .         .         .         .         .         .
21920 261IO         .         .         .         .         .         .      S  .         .         .         .         .         .
21930 262IO         .         .         .         .         .         .      S  .         .         .         .         .         .
21940 263IO         .         .         .         .         .         .      S  .         .         .         .         .         .
21950 264IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22000 265IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22010 266IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22020 267IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22030 268IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22040 269IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22050 270IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22100 271IO         .         .         .         .         .         .      S  .         .         .         .         .         .
22110 272I          .         .         .         .         .         .      S  .         .         .         .         .         .
22120 273I          .         .         .         .         .         .      S  .         .         .         .         .         .
22130 274I          .         .         .         .         .         .     S   .         .         .         .         .         .
22140 275I          .         .         .         .         .         .     S   .         .         .         .         .         .
22150 276I          .         .         .         .         .         .     S   .         .         .         .         .         .
22200 277I          .         .         .         .         .         .     S   .         .         .         .         .         .
22210 278I          .         .         .         .         .         .     S   .         .         .         .         .         .
22220 279I          .         .         .         .         .         .     S   .         .         .         .         .         .
22230 280I          .         .         .         .         .         .     S   .         .         .         .         .         .
22240 281I          .         .         .         .         .         .     S   .         .         .         .         .         .
22250 282I          .         .         .         .         .         .     S   .         .         .         .         .         .
22300 283I          .         .         .         .         .         .     S   .         .         .         .         .         .
22310 284I          .         .         .         .         .         .     S   .         .         .         .         .         .
22320 285I          .         .         .         .         .         .     S   .         .         .         .         .         .
22330 286I          .         .         .         .         .         .     S   .         .         .         .         .         .
22340 287I          .         .         .         .         .         .     S   .         .         .         .         .         .
22350 288I          .         .         .         .         .         .     S   .         .         .         .         .         .
30000 289I          .         .         .         .         .         .     S   .         .         .         .         .         .
30010 290I          .         .         .         .         .         .     S   .         .         .         .         .         .
30020 291I          .         .         .         .         .         .     S   .         .         .         .         .         .
30030 292I          .         .         .         .         .         .     S   .         .         .         .         .         .
30040 293I          .         .         .         .         .         .     S   .         .         .         .         .         .
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 30050 294I        .         .         .         .         .         .         S         .         .         .         .         .         .
 30100 295I        .         .         .         .         .         .         S         .         .         .         .         .         .
 30110 296I        .         .         .         .         .         .         S         .         .         .         .         .         .
 30120 297I        .         .         .         .         .         .         S         .         .         .         .         .         .
 30130 298I        .         .         .         .         .         .         S         .         .         .         .         .         .
 30140 299I        .         .         .         .         .         .         S         .         .         .         .         .         .
 30150 300I---------.---------.---------.---------.---------.---------.-------S---------.---------.---------.---------.---------.---------.
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              *            *
 156 KK       *      POND  *     2
              *            *
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 158 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          1  PRINT CONTROL
                      IPLOT          2  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

               HYDROGRAPH ROUTING DATA

 159 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       ELEV  TYPE OF INITIAL CONDITION
                     RSVRIC      25.50  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 160 SV            STORAGE         .0        .0        .1        .2        .4        .6        .9       1.2       1.6       2.1
                                  2.4

 162 SE          ELEVATION      18.00     20.00     22.00     24.00     26.00     28.00     30.00     32.00     34.00     36.00
                                37.00

 164 SQ          DISCHARGE         0.        0.        0.        1.        1.        1.        4.        6.       12.       19.
                                  23.       32.       40.       43.       51.       59.       64.       73.

 166 SE          ELEVATION      25.50     27.00     29.00     31.00     33.00     35.00     35.20     35.30     35.50     35.70
                                35.80     36.00     36.20     36.30     36.50     36.70     36.80     37.00
                                                                ***
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COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	.03	.09	.19	.32	.36	.47	.58	.72	.86
OUTFLOW	.00	.00	.00	.00	.00	.10	.29	.37	.44	.50
ELEVATION	18.00	20.00	22.00	24.00	25.50	26.00	27.00	28.00	29.00	30.00
STORAGE	1.03	1.20	1.41	1.62	1.87	1.92	1.94	1.99	2.05	2.07
OUTFLOW	.55	.60	.65	.69	.73	3.50	5.81	11.68	18.90	22.90
ELEVATION	31.00	32.00	33.00	34.00	35.00	35.20	35.30	35.50	35.70	35.80
STORAGE	2.12	2.17	2.19	2.24	2.30	2.32	2.37			
OUTFLOW	31.80	40.00	43.29	50.84	59.32	63.65	72.78			
ELEVATION	36.00	36.20	36.30	36.50	36.70	36.80	37.00			

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 19. TO 73.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

HYDROGRAPH AT STATION POND

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
							(columns continued from p.10)							(columns continued from p.10)						
1		0000	1	0.	.3	25.5	1		1640	101	1.	1.1	31.4	2		0920	201	1.	1.8	34.7
1		0010	2	0.	.3	25.5	1		1650	102	1.	1.1	31.5	2		0930	202	1.	1.8	34.7
1		0020	3	0.	.3	25.5	1		1700	103	1.	1.1	31.5	2		0940	203	1.	1.8	34.7
1		0030	4	0.	.3	25.5	1		1710	104	1.	1.1	31.6	2		0950	204	1.	1.8	34.7
1		0040	5	0.	.3	25.5	1		1720	105	1.	1.1	31.7	2		1000	205	1.	1.8	34.7
1		0050	6	0.	.3	25.5	1		1730	106	1.	1.2	31.7	2		1010	206	1.	1.8	34.7
1		0100	7	0.	.3	25.5	1		1740	107	1.	1.2	31.8	2		1020	207	1.	1.8	34.7
1		0110	8	0.	.3	25.5	1		1750	108	1.	1.2	31.9	2		1030	208	1.	1.8	34.7
1		0120	9	0.	.3	25.5	1		1800	109	1.	1.2	31.9	2		1040	209	1.	1.8	34.8
1		0130	10	0.	.3	25.5	1		1810	110	1.	1.2	32.0	2		1050	210	1.	1.8	34.8
1		0140	11	0.	.3	25.5	1		1820	111	1.	1.2	32.1	2		1100	211	1.	1.8	34.8
1		0150	12	0.	.3	25.5	1		1830	112	1.	1.2	32.1	2		1110	212	1.	1.8	34.8
1		0200	13	0.	.3	25.5	1		1840	113	1.	1.2	32.2	2		1120	213	1.	1.8	34.8
1		0210	14	0.	.3	25.5	1		1850	114	1.	1.2	32.2	2		1130	214	1.	1.8	34.8
1		0220	15	0.	.3	25.5	1		1900	115	1.	1.3	32.3	2		1140	215	1.	1.8	34.8
1		0230	16	0.	.3	25.5	1		1910	116	1.	1.3	32.3	2		1150	216	1.	1.8	34.8
1		0240	17	0.	.3	25.5	1		1920	117	1.	1.3	32.4	2		1200	217	1.	1.8	34.8
1		0250	18	0.	.3	25.5	1		1930	118	1.	1.3	32.4	2		1210	218	1.	1.8	34.7
1		0300	19	0.	.3	25.5	1		1940	119	1.	1.3	32.4	2		1220	219	1.	1.8	34.7
1		0310	20	0.	.3	25.5	1		1950	120	1.	1.3	32.5	2		1230	220	1.	1.8	34.7
1		0320	21	0.	.3	25.5	1		2000	121	1.	1.3	32.5	2		1240	221	1.	1.8	34.7
1		0330	22	0.	.3	25.5	1		2010	122	1.	1.3	32.6	2		1250	222	1.	1.8	34.7
1		0340	23	0.	.3	25.5	1		2020	123	1.	1.3	32.6	2		1300	223	1.	1.8	34.7
1		0350	24	0.	.3	25.5	1		2030	124	1.	1.3	32.7	2		1310	224	1.	1.8	34.7
1		0400	25	0.	.3	25.5	1		2040	125	1.	1.4	32.7	2		1320	225	1.	1.8	34.7
1		0410	26	0.	.3	25.5	1		2050	126	1.	1.4	32.8	2		1330	226	1.	1.8	34.7
1		0420	27	0.	.3	25.5	1		2100	127	1.	1.4	32.8	2		1340	227	1.	1.8	34.7
1		0430	28	0.	.3	25.5	1		2110	128	1.	1.4	32.9	2		1350	228	1.	1.8	34.7
1		0440	29	0.	.3	25.5	1		2120	129	1.	1.4	32.9	2		1400	229	1.	1.8	34.7
1		0450	30	0.	.3	25.5	1		2130	130	1.	1.4	33.0	2		1410	230	1.	1.8	34.7
1		0500	31	0.	.3	25.5	1		2140	131	1.	1.4	33.0	2		1420	231	1.	1.8	34.7
1		0510	32	0.	.3	25.5	1		2150	132	1.	1.4	33.0	2		1430	232	1.	1.8	34.7
1		0520	33	0.	.3	25.5	1		2200	133	1.	1.4	33.1	2		1440	233	1.	1.8	34.6
1		0530	34	0.	.3	25.5	1		2210	134	1.	1.4	33.1	2		1450	234	1.	1.8	34.6
1		0540	35	0.	.3	25.5	1		2220	135	1.	1.4	33.2	2		1500	235	1.	1.8	34.6
1		0550	36	0.	.3	25.5	1		2230	136	1.	1.5	33.2	2		1510	236	1.	1.8	34.6
1		0600	37	0.	.3	25.5	1		2240	137	1.	1.5	33.3	2		1520	237	1.	1.8	34.6
1		0610	38	0.	.3	25.5	1		2250	138	1.	1.5	33.3	2		1530	238	1.	1.8	34.6
1		0620	39	0.	.3	25.5	1		2300	139	1.	1.5	33.3	2		1540	239	1.	1.8	34.6
1		0630	40	0.	.3	25.5	1		2310	140	1.	1.5	33.4	2		1550	240	1.	1.8	34.6
1		0640	41	0.	.3	25.5	1		2320	141	1.	1.5	33.4	2		1600	241	1.	1.8	34.6
1		0650	42	0.	.3	25.5	1		2330	142	1.	1.5	33.5	2		1610	242	1.	1.8	34.5
1		0700	43	0.	.3	25.5	1		2340	143	1.	1.5	33.5	2		1620	243	1.	1.8	34.5
1		0710	44	0.	.3	25.5	1		2350	144	1.	1.5	33.5	2		1630	244	1.	1.7	34.5
1		0720	45	0.	.3	25.5	2		0000	145	1.	1.5	33.6	2		1640	245	1.	1.7	34.5
1		0730	46	0.	.3	25.5	2		0010	146	1.	1.5	33.6	2		1650	246	1.	1.7	34.5
1		0740	47	0.	.3	25.6	2		0020	147	1.	1.5	33.7	2		1700	247	1.	1.7	34.5
1		0750	48	0.	.3	25.6	2		0030	148	1.	1.6	33.7	2		1710	248	1.	1.7	34.5
1		0800	49	0.	.3	25.6	2		0040	149	1.	1.6	33.7	2		1720	249	1.	1.7	34.4
1		0810	50	0.	.3	25.6	2		0050	150	1.	1.6	33.8	2		1730	250	1.	1.7	34.4
1		0820	51	0.	.3	25.6	2		0100	151	1.	1.6	33.8	2		1740	251	1.	1.7	34.4
1		0830	52	0.	.3	25.6	2		0110	152	1.	1.6	33.8	2		1750	252	1.	1.7	34.4
1		0840	53	0.	.3	25.6	2		0120	153	1.	1.6	33.9	2		1800	253	1.	1.7	34.4
1		0850	54	0.	.3	25.6	2		0130	154	1.	1.6	33.9	2		1810	254	1.	1.7	34.3
1		0900	55	0.	.3	25.6	2		0140	155	1.	1.6	33.9	2		1820	255	1.	1.7	34.3
1		0910	56	0.	.3	25.6	2		0150	156	1.	1.6	34.0	2		1830	256	1.	1.7	34.3
1		0920	57	0.	.3	25.6	2		0200	157	1.	1.6	34.0	2		1840	257	1.	1.7	34.3
1		0930	58	0.	.3	25.6	2		0210	158	1.	1.6	34.0	2		1850	258	1.	1.7	34.3
1		0940	59	0.	.3	25.6	2		0220	159	1.	1.6	34.0	2		1900	259	1.	1.7	34.2
1		0950	60	0.	.3	25.7	2		0230	160	1.	1.6	34.1	2		1910	260	1.	1.7	34.2
1		1000	61	0.	.3	25.7	2		0240	161	1.	1.6	34.1	2		1920	261	1.	1.7	34.2
1		1010	62	0.	.3	25.7	2		0250	162	1.	1.7	34.1	2		1930	262	1.	1.7	34.2
1		1020	63	0.	.3	25.7	2		0300	163	1.	1.7	34.1	2		1940	263	1.	1.7	34.1
1		1030	64	0.	.3	25.7	2		0310	164	1.	1.7	34.2	2		1950	264	1.	1.6	34.1
1		1040	65	0.	.3	25.8	2		0320	165	1.	1.7	34.2	2		2000	265	1.	1.6	34.1

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		1050	66	0.	.3	25.8	*	2		0330	166	1.	1.7	34.2	*	2		2010	266	1.	1.6	34.1
1		1100	67	0.	.3	25.8	*	2		0340	167	1.	1.7	34.2	*	2		2020	267	1.	1.6	34.0
1		1110	68	0.	.3	25.9	*	2		0350	168	1.	1.7	34.3	*	2		2030	268	1.	1.6	34.0
1		1120	69	0.	.4	25.9	*	2		0400	169	1.	1.7	34.3	*	2		2040	269	1.	1.6	34.0
1		1130	70	0.	.4	26.0	*	2		0410	170	1.	1.7	34.3	*	2		2050	270	1.	1.6	34.0
1		1140	71	0.	.4	26.0	*	2		0420	171	1.	1.7	34.3	*	2		2100	271	1.	1.6	33.9
1		1150	72	0.	.4	26.1	*	2		0430	172	1.	1.7	34.3	*	2		2110	272	1.	1.6	33.9
1		1200	73	0.	.4	26.1	*	2		0440	173	1.	1.7	34.4	*	2		2120	273	1.	1.6	33.9
1		1210	74	0.	.4	26.3	*	2		0450	174	1.	1.7	34.4	*	2		2130	274	1.	1.6	33.8
1		1220	75	0.	.4	26.5	*	2		0500	175	1.	1.7	34.4	*	2		2140	275	1.	1.6	33.8
1		1230	76	0.	.5	26.9	*	2		0510	176	1.	1.7	34.4	*	2		2150	276	1.	1.6	33.8
1		1240	77	0.	.5	27.1	*	2		0520	177	1.	1.7	34.4	*	2		2200	277	1.	1.6	33.7
1		1250	78	0.	.5	27.3	*	2		0530	178	1.	1.7	34.4	*	2		2210	278	1.	1.6	33.7
1		1300	79	0.	.5	27.5	*	2		0540	179	1.	1.7	34.5	*	2		2220	279	1.	1.5	33.7
1		1310	80	0.	.6	27.8	*	2		0550	180	1.	1.7	34.5	*	2		2230	280	1.	1.5	33.6
1		1320	81	0.	.6	28.2	*	2		0600	181	1.	1.7	34.5	*	2		2240	281	1.	1.5	33.6
1		1330	82	0.	.7	28.5	*	2		0610	182	1.	1.7	34.5	*	2		2250	282	1.	1.5	33.6
1		1340	83	0.	.7	28.9	*	2		0620	183	1.	1.8	34.5	*	2		2300	283	1.	1.5	33.5
1		1350	84	0.	.7	29.2	*	2		0630	184	1.	1.8	34.5	*	2		2310	284	1.	1.5	33.5
1		1400	85	0.	.8	29.5	*	2		0640	185	1.	1.8	34.6	*	2		2320	285	1.	1.5	33.4
1		1410	86	0.	.8	29.7	*	2		0650	186	1.	1.8	34.6	*	2		2330	286	1.	1.5	33.4
1		1420	87	0.	.9	29.9	*	2		0700	187	1.	1.8	34.6	*	2		2340	287	1.	1.5	33.4
1		1430	88	1.	.9	30.1	*	2		0710	188	1.	1.8	34.6	*	2		2350	288	1.	1.5	33.3
1		1440	89	1.	.9	30.3	*	2		0720	189	1.	1.8	34.6	*	3		0000	289	1.	1.5	33.3
1		1450	90	1.	.9	30.4	*	2		0730	190	1.	1.8	34.6	*	3		0010	290	1.	1.5	33.3
1		1500	91	1.	1.0	30.6	*	2		0740	191	1.	1.8	34.6	*	3		0020	291	1.	1.5	33.2
1		1510	92	1.	1.0	30.7	*	2		0750	192	1.	1.8	34.6	*	3		0030	292	1.	1.5	33.2
1		1520	93	1.	1.0	30.8	*	2		0800	193	1.	1.8	34.6	*	3		0040	293	1.	1.4	33.2
1		1530	94	1.	1.0	30.9	*	2		0810	194	1.	1.8	34.7	*	3		0050	294	1.	1.4	33.1
1		1540	95	1.	1.0	31.0	*	2		0820	195	1.	1.8	34.7	*	3		0100	295	1.	1.4	33.1
1		1550	96	1.	1.0	31.1	*	2		0830	196	1.	1.8	34.7	*	3		0110	296	1.	1.4	33.1
1		1600	97	1.	1.1	31.1	*	2		0840	197	1.	1.8	34.7	*	3		0120	297	1.	1.4	33.0
1		1610	98	1.	1.1	31.2	*	2		0850	198	1.	1.8	34.7	*	3		0130	298	1.	1.4	33.0
1		1620	99	1.	1.1	31.3	*	2		0900	199	1.	1.8	34.7	*	3		0140	299	1.	1.4	32.9
1		1630	100	1.	1.1	31.3	*	2		0910	200	1.	1.8	34.7	*	3		0150	300	1.	1.4	32.9
							*								*							

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	49.83-HR
+ (CFS)	(HR)	(CFS)				
+ 1.	34.00		1.	1.	1.	1.
		(INCHES)	.163	.636	.940	.940
		(AC-FT)	0.	1.	2.	2.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	49.83-HR
+ (AC-FT)	(HR)				
2.	34.83	2.	2.	1.	1.

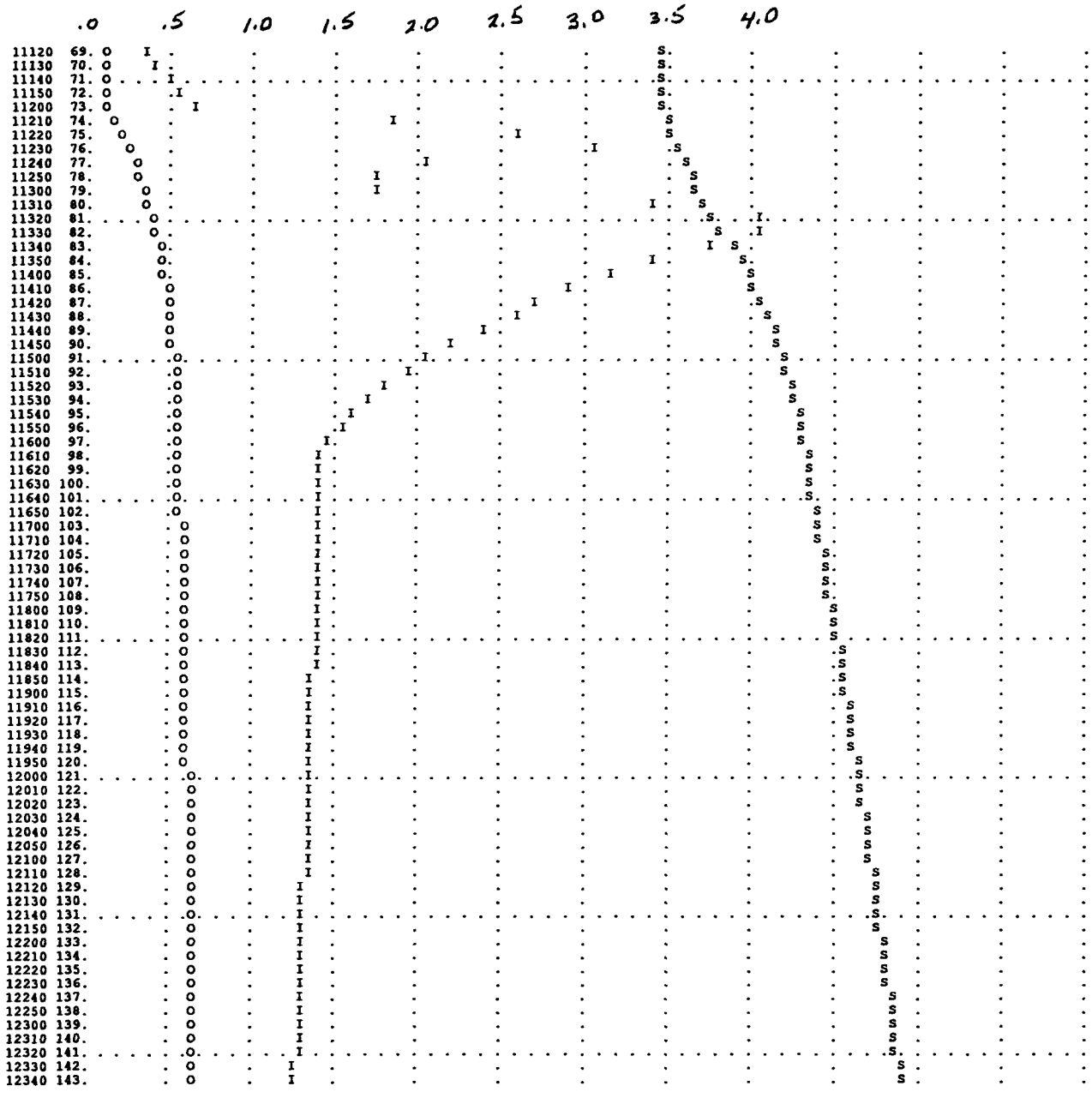
PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	49.83-HR
+ (FEET)	(HR)				
34.76	35.33	34.73	34.32	31.46	31.46

CUMULATIVE AREA = .04 SQ MI

1 STATION POND

(I) INFLOW, (O) OUTFLOW

		.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	.0	.0	.0
									(S) STORAGE					
		.0	.0	.0	.0	.0	.0	.0	.4	.8	1.2	1.6	2.0	.0
DAHRMN	PER													
10000	1I								S					
10010	2I								S					
10020	3I								S					
10030	4I								S					
10040	5I								S					
10050	6I								S					
10100	7I								S					
10110	8I								S					
10120	9I								S					
10130	10I								S					
10140	11I								S					
10150	12I								S					
10200	13I								S					
10210	14I								S					
10220	15I								S					
10230	16I								S					
10240	17I								S					
10250	18I								S					
10300	19I								S					
10310	20I								S					
10320	21I								S					
10330	22I								S					
10340	23I								S					
10350	24I								S					
10400	25I								S					
10410	26I								S					
10420	27I								S					
10430	28I								S					
10440	29I								S					
10450	30I								S					
10500	31I								S					
10510	32I								S					
10520	33I								S					
10530	34I								S					
10540	35I								S					
10550	36I								S					
10600	37I								S					
10610	38I								S					
10620	39I								S					
10630	40I								S					
10640	41I								S					
10650	42I								S					
10700	43I								S					
10710	44OI								S					
10720	45OI								S					
10730	46OI								S					
10740	47OI								S					
10750	48OI								S					
10800	49OI								S					
10810	50OI								S					
10820	51OI								S					
10830	52OI								S					
10840	53OI								S					
10850	54OI								S					
10900	55OI								S					
10910	56O I								S					
10920	57O I								S					
10930	58.OI								S					
10940	59.OI								S					
10950	60.O I								S					
11000	61.O.I								S					
11010	62.O I								S					
11020	63.O I								S					
11030	64.O I								S					
11040	65.O I								S					
11050	66.O I								S					
11100	67.O I								S					
11110	68.O I								S					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11220 75.
11230 76.
11240 77.
11250 78.
11300 79.
11310 80.
11320 81.
11330 82.
11340 83.
11350 84.
11400 85.
11410 86.
11420 87.
11430 88.
11440 89.
11450 90.
11500 91.
11510 92.
11520 93.
11530 94.
11540 95.
11550 96.
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11610 98.
11620 99.
11630 100.
11640 101.
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11700 103.
11710 104.
11720 105.
11730 106.
11740 107.
11750 108.
11800 109.
11810 110.
11820 111.
11830 112.
11840 113.
11850 114.
11900 115.
11910 116.
11920 117.
11930 118.
11940 119.
11950 120.
12000 121.
12010 122.
12020 123.
12030 124.
12040 125.
12050 126.
12100 127.
12110 128.
12120 129.
12130 130.
12140 131.
12150 132.
12200 133.
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12250 138.
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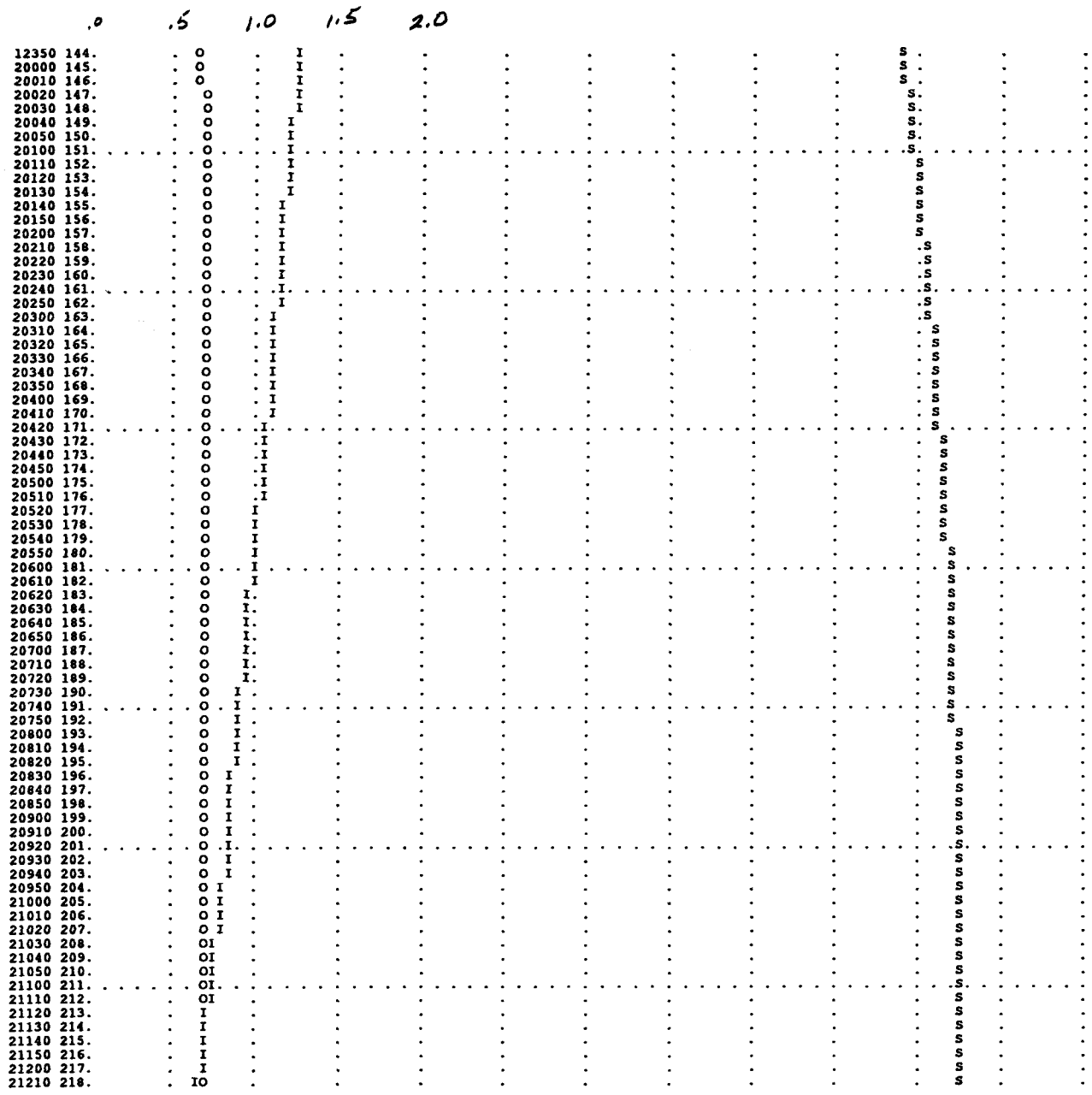
12310 140.
12320 141.
12330 142.
12340 143.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1.5
2.0
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20100 151.
20110 152.
20120 153.
20130 154.
20140 155.
20150 156.
20200 157.
20210 158.
20220 159.
20230 160.
20240 161.
20250 162.
20300 163.
20310 164.
20320 165.
20330 166.
20340 167.
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20400 169.
20410 170.
20420 171.
20430 172.
20440 173.
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20500 175.
20510 176.
20520 177.
20530 178.
20540 179.
20550 180.
20600 181.
20610 182.
20620 183.
20630 184.
20640 185.
20650 186.
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20710 188.
20720 189.
20730 190.
20740 191.
20750 192.
20800 193.
20810 194.
20820 195.
20830 196.
20840 197.
20850 198.
20900 199.
20910 200.
20920 201.
20930 202.
20940 203.
20950 204.
21000 205.
21010 206.
21020 207.
21030 208.
21040 209.
21050 210.
21100 211.
21110 212.
21120 213.
21130 214.
21140 215.
21150 216.
21200 217.
21210 218.

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      .0      .5      1.0
21220 219.        .  IO    .         .         .         .         .         .         .         .         .    S    .         .
21230 220.        .  IO    .         .         .         .         .         .         .         .         .    S    .         .
21240 221. . . . . .  IO . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .    S. . . . . .
21250 222.        .  IO    .         .         .         .         .         .         .         .         .    S    .         .
21300 223.        . I O    .         .         .         .         .         .         .         .         .    S    .         .
21310 224.        . I O    .         .         .         .         .         .         .         .         .    S    .         .
21320 225.        . I O    .         .         .         .         .         .         .         .         .    S    .         .
21330 226.        . I O    .         .         .         .         .         .         .         .         .    S    .         .
21340 227.        . I O    .         .         .         .         .         .         .         .         .    S    .         .
21350 228.        . I O    .         .         .         .         .         .         .         .         .    S    .         .
21400 229.        .I  O    .         .         .         .         .         .         .         .         .    S    .         .
21410 230.        .I  O    .         .         .         .         .         .         .         .         .    S    .         .
21420 231. . . . . .I. O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .    S. . . . . .
21430 232.        .I  O    .         .         .         .         .         .         .         .         .    S    .         .
21440 233.        .I  O    .         .         .         .         .         .         .         .         .    S    .         .
21450 234.        .I  O    .         .         .         .         .         .         .         .         .  S      .         .
21500 235.        I   O    .         .         .         .         .         .         .         .         .  S      .         .
21510 236.        I   O    .         .         .         .         .         .         .         .         .  S      .         .
21520 237.        I   O    .         .         .         .         .         .         .         .         .  S      .         .
21530 238.        I   O    .         .         .         .         .         .         .         .         .  S      .         .
21540 239.        I   O    .         .         .         .         .         .         .         .         .  S      .         .
21550 240.        I   O    .         .         .         .         .         .         .         .         .  S      .         .
21600 241. . . . . I . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S. . . . . .
21610 242.       I.   O    .         .         .         .         .         .         .         .         .  S      .         .
21620 243.       I.   O    .         .         .         .         .         .         .         .         .  S      .         .
21630 244.       I.   O    .         .         .         .         .         .         .         .         .  S      .         .
21640 245.       I.   O    .         .         .         .         .         .         .         .         .  S      .         .
21650 246.       I.   O    .         .         .         .         .         .         .         .         .  S      .         .
21700 247.      I .   O    .         .         .         .         .         .         .         .         .    S    .         .
21710 248.      I .   O    .         .         .         .         .         .         .         .         .    S    .         .
21720 249.      I .   O    .         .         .         .         .         .         .         .         .    S    .         .
21730 250.      I .   O    .         .         .         .         .         .         .         .         .    S    .         .
21740 251. . . .I. . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .    S. . . . . .
21750 252.     I  .   O    .         .         .         .         .         .         .         .         .    S    .         .
21800 253.     I  .   O    .         .         .         .         .         .         .         .         .    S    .         .
21810 254.     I  .   O    .         .         .         .         .         .         .         .         .    S    .         .
21820 255.    I   .   O    .         .         .         .         .         .         .         .         .    S    .         .
21830 256.    I   .   O    .         .         .         .         .         .         .         .         . S      .         .
21840 257.    I   .   O    .         .         .         .         .         .         .         .         . S      .         .
21850 258.    I   .   O    .         .         .         .         .         .         .         .         . S      .         .
21900 259.    I   .   O    .         .         .         .         .         .         .         .         . S      .         .
21910 260.    I   .   O    .         .         .         .         .         .         .         .         . S      .         .
21920 261. . .I.  . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .    S. . . . . .
21930 262.   I    .   O    .         .         .         .         .         .         .         .         .    S    .         .
21940 263.   I    .   O    .         .         .         .         .         .         .         .         .S     .         .
21950 264.   I    .   O    .         .         .         .         .         .         .         .         .S     .         .
22000 265.   I    .   O    .         .         .         .         .         .         .         .         .S     .         .
22010 266.   I    .   O    .         .         .         .         .         .         .         .         .S     .         .
22020 267.   I    .   O    .         .         .         .         .         .         .         .         .S     .         .
22030 268.  I     .   O    .         .         .         .         .         .         .         .         .S     .         .
22040 269.  I     .   O    .         .         .         .         .         .         .         .         S      .         .
22050 270.  I     .   O    .         .         .         .         .         .         .         .         S      .         .
22100 271. . I . . . . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .    S. . . . . .
22110 272.  I     .   O    .         .         .         .         .         .         .         .         S      .         .
22120 273.  I     .   O    .         .         .         .         .         .         .         .         S      .         .
22130 274.  I     .   O    .         .         .         .         .         .         .         .         S      .         .
22140 275.  I     .   O    .         .         .         .         .         .         .         .       S.       .         .
22150 276. I      .   O    .         .         .         .         .         .         .         .       S.       .         .
22200 277. I      .   O    .         .         .         .         .         .         .         .       S.       .         .
22210 278. I      .   O    .         .         .         .         .         .         .         .       S.       .         .
22220 279. I      .   O    .         .         .         .         .         .         .         .       S.       .         .
22230 280. I      .  O     .         .         .         .         .         .         .         .       S.       .         .
22240 281. .I. . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .     S. . . . . .
22250 282. I      .  O     .         .         .         .         .         .         .         .       S.       .         .
22300 283. I      .  O     .         .         .         .         .         .         .         .       S.       .         .
22310 284. I      .  O     .         .         .         .         .         .         .         .       S.       .         .
22320 285. I      .  O     .         .         .         .         .         .         .         .       S.       .         .
22330 286. I      .  O     .         .         .         .         .         .         .         .     S        .         .
22340 287. I      .  O     .         .         .         .         .         .         .         .     S        .         .
22350 288. I      .  O     .         .         .         .         .         .         .         .     S        .         .
30000 289. I      .  O     .         .         .         .         .         .         .         .     S        .         .
30010 290. I      .  O     .         .         .         .         .         .         .         .     S        .         .
30020 291. I . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .   S. . . . . .
30030 292. I      .  O     .         .         .         .         .         .         .         .     S        .         .
30040 293. I      .  O     .         .         .         .         .         .         .         .     S        .         .
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      .0     .5     1.0
30050 294. I      . O     .       .       .       .       .       .       .       .       . S     .       .       .
30100 295. I      . O     .       .       .       .       .       .       .       .       . S     .       .       .
30110 296. I      . O     .       .       .       .       .       .       .       .       . S     .       .       .
30120 297. I      . O     .       .       .       .       .       .       .       .       S       .       .       .
30130 298. I      . O     .       .       .       .       .       .       .       .       S       .       .       .
30140 299. I      . O     .       .       .       .       .       .       .       .       S       .       .       .
30150 300.-I------.--O-----.-------.-------.-------.-------.-------.-------.-------.-------S-------.-------.-------.
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	DA-1	8.	12.50	1.	0.	0.	.01		
+	ROUTED TO	CD-1	8.	12.50	1.	0.	0.	.01		
+	ROUTED TO	ROUTE	8.	12.50	1.	0.	0.	.01		
+	HYDROGRAPH AT	DA-2	4.	12.50	1.	0.	0.	.00		
+	ROUTED TO	CD-2	4.	12.50	1.	0.	0.	.00		
+	ROUTED TO	ROUTE	4.	12.50	1.	0.	0.	.00		
+	HYDROGRAPH AT	DA-3	2.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-3	2.	12.50	0.	0.	0.	.00		
+	ROUTED TO	ROUTE	2.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-4	4.	12.50	1.	0.	0.	.00		
+	4 COMBINED AT	CD-4	18.	12.50	3.	1.	0.	.02		
+	ROUTED TO	CD-4	18.	12.50	3.	1.	0.	.02		
+	HYDROGRAPH AT	DA-5	0.	12.50	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	18.	12.50	3.	1.	0.	.02		
+	ROUTED TO	CD-5	18.	12.50	3.	1.	0.	.02		
+	HYDROGRAPH AT	DA-6	4.	12.50	1.	0.	0.	.01		
+	2 COMBINED AT	COMBINE	22.	12.50	3.	1.	0.	.03		
+	ROUTED TO	CD-6	22.	12.50	3.	1.	0.	.03		
+	HYDROGRAPH AT	DA-7	3.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-8	0.	12.50	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	3.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-8	3.	12.50	0.	0.	0.	.00		

+	2 COMBINED AT	COMBINE	25.	12.50	4.	1.	1.	.03		
+	ROUTED TO	CD-8	25.	12.50	4.	1.	1.	.03		
+	HYDROGRAPH AT	DA-9	3.	12.50	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	28.	12.50	4.	1.	1.	.03		
+	ROUTED TO	CD-9	28.	12.50	4.	1.	1.	.03		
+	HYDROGRAPH AT	DA-10	1.	12.50	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	28.	12.50	4.	1.	1.	.03		
+	ROUTED TO	CD-10	28.	12.50	4.	1.	1.	.03		
+	HYDROGRAPH AT	DA-11	2.	12.50	0.	0.	0.	.00		
+	2 COMBINED AT	COMBINE	30.	12.50	4.	1.	1.	.04		
+	ROUTED TO	CD-11	30.	12.50	4.	1.	1.	.04		
+	HYDROGRAPH AT	DA-12	1.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-12	1.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-13	0.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-13	0.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-14	1.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-14	1.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-17	1.	12.50	0.	0.	0.	.00		
+	5 COMBINED AT	NORTH	33.	12.50	5.	2.	1.	.04		
+	ROUTED TO	POND	4.	13.50	2.	1.	1.	.04		
+									65.18	13.50
+	HYDROGRAPH AT	DA-15	1.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-15	1.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-16	0.	12.50	0.	0.	0.	.00		
+	ROUTED TO	CD-16	0.	12.50	0.	0.	0.	.00		
+	HYDROGRAPH AT	DA-18	1.	12.50	0.	0.	0.	.00		

```
                4 COMBINED AT
+                               SOUTH        4.   13.33          2.          1.          1.        .04
                ROUTED TO
+                               POND         1.   34.00          1.          1.          1.        .04
+                                                                                                          34.76       35.33
```

*** NORMAL END OF HEC-1 ***

EXTENSION RUN

1 ****
FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 SOUTH POND MODELED FROM END OF INITIAL RUN (see previous printout) t = 50 hours to t = 100 hours from beginning of storm.

HEC-1 INPUT PAGE 1

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID     UP&L Mining - Wilberg Mine Portal Facilities
            2           ID     10-YR 24-HR  SCS TYPE II DISTRIBUTION
            3           ID     by JAH Hansen, Allen & Luce  SEPT. 1991
*** FREE ***
                        *DIAGRAM
            4           IT      10       0       0     300
            5           IO       5

            6           KK DUMMYIN
            7           IN      30
            8           QI      0.      0.      0.      0.      0.      0.      0.      0.

            9           KK    POND2
           10           KM
           11           KO       1       2
           12           RS       1    ELEV    32.9
           13           SV       0     .03     .09     .19     .36     .58     .86    1.20    1.62    2.12
           14           SV    2.37
           15           SE    18.0    20.0    22.0    24.0    26.0    28.0    30.0    32.0    34.0    36.0
           16           SE    37.0
           17           SQ       0     .29     .44     .55     .65     .73     3.5    5.81   11.68    18.9
           18           SQ    22.9    31.8    40.0   43.29   50.84   59.32   63.65   72.78
           19           SE    25.5    27.0    29.0    31.0    33.0    35.0    35.2    35.3    35.5    35.7
           20           SE    35.8    36.0    36.2    36.3    36.5    36.7    36.8    37.0
           21           ZZ
```

start elevation = end of run elevation for previous (initial run).

```
                SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE       (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

                V
                V
    9         POND

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

                                                        ****
1                          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
                U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                        ****



                         UP&L Mining - Wilberg Mine Portal Facilities
                         10-YR 24-HR  SCS TYPE II DISTRIBUTION
                         by JAH Hansen, Allen & Luce  SEPT. 1991

   5 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          10  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      3    0  ENDING DATE
                      NDTIME        0150  ENDING TIME

                  COMPUTATION INTERVAL     .17 HOURS
                       TOTAL TIME BASE   49.83 HOURS

          ENGLISH UNITS
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
   9 KK     *      POND  *     2
            *            *
            **************

  11 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           1  PRINT CONTROL
                       IPLOT           2  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

              HYDROGRAPH ROUTING DATA

  12 RS          STORAGE ROUTING
                       NSTPS           1  NUMBER OF SUBREACHES
                        ITYP        ELEV  TYPE OF INITIAL CONDITION
                      RSVRIC       32.90  INITIAL CONDITION
                           X         .00 WORKING R AND D COEFFICIENT

  13 SV            STORAGE          .0       .0       .1       .2       .4       .6       .9      1.2      1.6      2.1
                                   2.4

  15 SE          ELEVATION       18.00    20.00    22.00    24.00    26.00    28.00    30.00    32.00    34.00    36.00
                                 37.00

  17 SQ          DISCHARGE         0.       0.       0.       1.       1.       1.       4.       6.      12.      19.
                                  23.      32.      40.      43.      51.      59.      64.      73.

  19 SE          ELEVATION       25.50    27.00    29.00    31.00    33.00    35.00    35.20    35.30    35.50    35.70
                                 35.80    36.00    36.20    36.30    36.50    36.70    36.80    37.00
```

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	.03	.09	.19	.32	.36	.47	.58	.72	.86
OUTFLOW	.00	.00	.00	.00	.00	.10	.29	.37	.44	.50
ELEVATION	18.00	20.00	22.00	24.00	25.50	26.00	27.00	28.00	29.00	30.00
STORAGE	1.03	1.20	1.41	1.62	1.87	1.92	1.94	1.99	2.05	2.07
OUTFLOW	.55	.60	.65	.69	.73	3.50	5.81	11.68	18.90	22.90
ELEVATION	31.00	32.00	33.00	34.00	35.00	35.20	35.30	35.50	35.70	35.80
STORAGE	2.12	2.17	2.19	2.24	2.30	2.32	2.37			
OUTFLOW	31.80	40.00	43.29	50.84	59.32	63.65	72.78			
ELEVATION	36.00	36.20	36.30	36.50	36.70	36.80	37.00			

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 19. TO 73.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

****

HYDROGRAPH AT STATION POND

****

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
							*			(columns continued from p. 5)					*			(columns continued from p. 5)				
1		0000	1	1.	1.4	32.9	*	1		1640	101	0.	.7	28.5	*	2		0920	201	0.	.3	25.8
1		0010	2	1.	1.4	32.9	*	1		1650	102	0.	.7	28.5	*	2		0930	202	0.	.3	25.8
1		0020	3	1.	1.4	32.8	*	1		1700	103	0.	.6	28.5	*	2		0940	203	0.	.3	25.8
1		0030	4	1.	1.4	32.8	*	1		1710	104	0.	.6	28.4	*	2		0950	204	0.	.3	25.8
1		0040	5	1.	1.4	32.7	*	1		1720	105	0.	.6	28.4	*	2		1000	205	0.	.3	25.8
1		0050	6	1.	1.3	32.7	*	1		1730	106	0.	.6	28.3	*	2		1010	206	0.	.3	25.8
1		0100	7	1.	1.3	32.6	*	1		1740	107	0.	.6	28.3	*	2		1020	207	0.	.3	25.8
1		0110	8	1.	1.3	32.6	*	1		1750	108	0.	.6	28.3	*	2		1030	208	0.	.3	25.7
1		0120	9	1.	1.3	32.6	*	1		1800	109	0.	.6	28.2	*	2		1040	209	0.	.3	25.7
1		0130	10	1.	1.3	32.5	*	1		1810	110	0.	.6	28.2	*	2		1050	210	0.	.3	25.7
1		0140	11	1.	1.3	32.5	*	1		1820	111	0.	.6	28.2	*	2		1100	211	0.	.3	25.7
1		0150	12	1.	1.3	32.4	*	1		1830	112	0.	.6	28.1	*	2		1110	212	0.	.3	25.7
1		0200	13	1.	1.3	32.4	*	1		1840	113	0.	.6	28.1	*	2		1120	213	0.	.3	25.7
1		0210	14	1.	1.3	32.4	*	1		1850	114	0.	.6	28.0	*	2		1130	214	0.	.3	25.7
1		0220	15	1.	1.3	32.3	*	1		1900	115	0.	.6	28.0	*	2		1140	215	0.	.3	25.7
1		0230	16	1.	1.3	32.3	*	1		1910	116	0.	.6	28.0	*	2		1150	216	0.	.3	25.7
1		0240	17	1.	1.3	32.2	*	1		1920	117	0.	.6	27.9	*	2		1200	217	0.	.3	25.7
1		0250	18	1.	1.2	32.2	*	1		1930	118	0.	.6	27.9	*	2		1210	218	0.	.3	25.7
1		0300	19	1.	1.2	32.2	*	1		1940	119	0.	.6	27.8	*	2		1220	219	0.	.3	25.7
1		0310	20	1.	1.2	32.1	*	1		1950	120	0.	.6	27.8	*	2		1230	220	0.	.3	25.7
1		0320	21	1.	1.2	32.1	*	1		2000	121	0.	.6	27.7	*	2		1240	221	0.	.3	25.7
1		0330	22	1.	1.2	32.0	*	1		2010	122	0.	.5	27.7	*	2		1250	222	0.	.3	25.7
1		0340	23	1.	1.2	32.0	*	1		2020	123	0.	.5	27.7	*	2		1300	223	0.	.3	25.7
1		0350	24	1.	1.2	32.0	*	1		2030	124	0.	.5	27.6	*	2		1310	224	0.	.3	25.6
1		0400	25	1.	1.2	31.9	*	1		2040	125	0.	.5	27.6	*	2		1320	225	0.	.3	25.6
1		0410	26	1.	1.2	31.9	*	1		2050	126	0.	.5	27.5	*	2		1330	226	0.	.3	25.6
1		0420	27	1.	1.2	31.8	*	1		2100	127	0.	.5	27.5	*	2		1340	227	0.	.3	25.6
1		0430	28	1.	1.2	31.8	*	1		2110	128	0.	.5	27.5	*	2		1350	228	0.	.3	25.6
1		0440	29	1.	1.2	31.7	*	1		2120	129	0.	.5	27.4	*	2		1400	229	0.	.3	25.6
1		0450	30	1.	1.1	31.7	*	1		2130	130	0.	.5	27.4	*	2		1410	230	0.	.3	25.6
1		0500	31	1.	1.1	31.6	*	1		2140	131	0.	.5	27.3	*	2		1420	231	0.	.3	25.6
1		0510	32	1.	1.1	31.6	*	1		2150	132	0.	.5	27.3	*	2		1430	232	0.	.3	25.6
1		0520	33	1.	1.1	31.5	*	1		2200	133	0.	.5	27.3	*	2		1440	233	0.	.3	25.6
1		0530	34	1.	1.1	31.5	*	1		2210	134	0.	.5	27.2	*	2		1450	234	0.	.3	25.6
1		0540	35	1.	1.1	31.4	*	1		2220	135	0.	.5	27.2	*	2		1500	235	0.	.3	25.6
1		0550	36	1.	1.1	31.4	*	1		2230	136	0.	.5	27.1	*	2		1510	236	0.	.3	25.6
1		0600	37	1.	1.1	31.3	*	1		2240	137	0.	.5	27.1	*	2		1520	237	0.	.3	25.6
1		0610	38	1.	1.1	31.3	*	1		2250	138	0.	.5	27.1	*	2		1530	238	0.	.3	25.6
1		0620	39	1.	1.1	31.2	*	1		2300	139	0.	.5	27.0	*	2		1540	239	0.	.3	25.6
1		0630	40	1.	1.1	31.2	*	1		2310	140	0.	.5	27.0	*	2		1550	240	0.	.3	25.6
1		0640	41	1.	1.1	31.2	*	1		2320	141	0.	.5	27.0	*	2		1600	241	0.	.3	25.6
1		0650	42	1.	1.0	31.1	*	1		2330	142	0.	.5	26.9	*	2		1610	242	0.	.3	25.6
1		0700	43	1.	1.0	31.1	*	1		2340	143	0.	.5	26.9	*	2		1620	243	0.	.3	25.6
1		0710	44	1.	1.0	31.0	*	1		2350	144	0.	.5	26.9	*	2		1630	244	0.	.3	25.6
1		0720	45	1.	1.0	31.0	*	2		0000	145	0.	.5	26.8	*	2		1640	245	0.	.3	25.6
1		0730	46	1.	1.0	30.9	*	2		0010	146	0.	.4	26.8	*	2		1650	246	0.	.3	25.6

(columns continued on next page) (columns continued on next page) (columns continued on next page)

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0740	47	1.	1.0	30.9	*	2		0020	147	0.	.4	26.8	*	2		1700	247	0.	.3	25.6
1		0750	48	1.	1.0	30.8	*	2		0030	148	0.	.4	26.7	*	2		1710	248	0.	.3	25.6
1		0800	49	1.	1.0	30.8	*	2		0040	149	0.	.4	26.7	*	2		1720	249	0.	.3	25.6
1		0810	50	1.	1.0	30.8	*	2		0050	150	0.	.4	26.7	*	2		1730	250	0.	.3	25.6
1		0820	51	1.	1.0	30.7	*	2		0100	151	0.	.4	26.6	*	2		1740	251	0.	.3	25.6
1		0830	52	1.	1.0	30.7	*	2		0110	152	0.	.4	26.6	*	2		1750	252	0.	.3	25.6
1		0840	53	1.	1.0	30.6	*	2		0120	153	0.	.4	26.6	*	2		1800	253	0.	.3	25.6
1		0850	54	1.	1.0	30.6	*	2		0130	154	0.	.4	26.6	*	2		1810	254	0.	.3	25.6
1		0900	55	1.	1.0	30.5	*	2		0140	155	0.	.4	26.5	*	2		1820	255	0.	.3	25.6
1		0910	56	1.	.9	30.5	*	2		0150	156	0.	.4	26.5	*	2		1830	256	0.	.3	25.6
1		0920	57	1.	.9	30.5	*	2		0200	157	0.	.4	26.5	*	2		1840	257	0.	.3	25.6
1		0930	58	1.	.9	30.4	*	2		0210	158	0.	.4	26.5	*	2		1850	258	0.	.3	25.6
1		0940	59	1.	.9	30.4	*	2		0220	159	0.	.4	26.4	*	2		1900	259	0.	.3	25.5
1		0950	60	1.	.9	30.3	*	2		0230	160	0.	.4	26.4	*	2		1910	260	0.	.3	25.5
1		1000	61	1.	.9	30.3	*	2		0240	161	0.	.4	26.4	*	2		1920	261	0.	.3	25.5
1		1010	62	1.	.9	30.3	*	2		0250	162	0.	.4	26.4	*	2		1930	262	0.	.3	25.5
1		1020	63	1.	.9	30.2	*	2		0300	163	0.	.4	26.4	*	2		1940	263	0.	.3	25.5
1		1030	64	1.	.9	30.2	*	2		0310	164	0.	.4	26.3	*	2		1950	264	0.	.3	25.5
1		1040	65	1.	.9	30.1	*	2		0320	165	0.	.4	26.3	*	2		2000	265	0.	.3	25.5
1		1050	66	0.	.9	30.1	*	2		0330	166	0.	.4	26.3	*	2		2010	266	0.	.3	25.5
1		1100	67	0.	.9	30.0	*	2		0340	167	0.	.4	26.3	*	2		2020	267	0.	.3	25.5
1		1110	68	0.	.9	30.0	*	2		0350	168	0.	.4	26.3	*	2		2030	268	0.	.3	25.5
1		1120	69	0.	.9	30.0	*	2		0400	169	0.	.4	26.2	*	2		2040	269	0.	.3	25.5
1		1130	70	0.	.8	29.9	*	2		0410	170	0.	.4	26.2	*	2		2050	270	0.	.3	25.5
1		1140	71	0.	.8	29.9	*	2		0420	171	0.	.4	26.2	*	2		2100	271	0.	.3	25.5
1		1150	72	0.	.8	29.8	*	2		0430	172	0.	.4	26.2	*	2		2110	272	0.	.3	25.5
1		1200	73	0.	.8	29.8	*	2		0440	173	0.	.4	26.2	*	2		2120	273	0.	.3	25.5
1		1210	74	0.	.8	29.7	*	2		0450	174	0.	.4	26.2	*	2		2130	274	0.	.3	25.5
1		1220	75	0.	.8	29.7	*	2		0500	175	0.	.4	26.1	*	2		2140	275	0.	.3	25.5
1		1230	76	0.	.8	29.6	*	2		0510	176	0.	.4	26.1	*	2		2150	276	0.	.3	25.5
1		1240	77	0.	.8	29.6	*	2		0520	177	0.	.4	26.1	*	2		2200	277	0.	.3	25.5
1		1250	78	0.	.8	29.5	*	2		0530	178	0.	.4	26.1	*	2		2210	278	0.	.3	25.5
1		1300	79	0.	.8	29.5	*	2		0540	179	0.	.4	26.1	*	2		2220	279	0.	.3	25.5
1		1310	80	0.	.8	29.4	*	2		0550	180	0.	.4	26.1	*	2		2230	280	0.	.3	25.5
1		1320	81	0.	.8	29.4	*	2		0600	181	0.	.4	26.1	*	2		2240	281	0.	.3	25.5
1		1330	82	0.	.8	29.4	*	2		0610	182	0.	.4	26.0	*	2		2250	282	0.	.3	25.5
1		1340	83	0.	.8	29.3	*	2		0620	183	0.	.4	26.0	*	2		2300	283	0.	.3	25.5
1		1350	84	0.	.8	29.3	*	2		0630	184	0.	.4	26.0	*	2		2310	284	0.	.3	25.5
1		1400	85	0.	.8	29.2	*	2		0640	185	0.	.4	26.0	*	2		2320	285	0.	.3	25.5
1		1410	86	0.	.7	29.2	*	2		0650	186	0.	.4	26.0	*	2		2330	286	0.	.3	25.5
1		1420	87	0.	.7	29.1	*	2		0700	187	0.	.4	26.0	*	2		2340	287	0.	.3	25.5
1		1430	88	0.	.7	29.1	*	2		0710	188	0.	.4	26.0	*	2		2350	288	0.	.3	25.5
1		1440	89	0.	.7	29.0	*	2		0720	189	0.	.4	25.9	*	3		0000	289	0.	.3	25.5
1		1450	90	0.	.7	29.0	*	2		0730	190	0.	.4	25.9	*	3		0010	290	0.	.3	25.5
1		1500	91	0.	.7	29.0	*	2		0740	191	0.	.4	25.9	*	3		0020	291	0.	.3	25.5
1		1510	92	0.	.7	28.9	*	2		0750	192	0.	.4	25.9	*	3		0030	292	0.	.3	25.5
1		1520	93	0.	.7	28.9	*	2		0800	193	0.	.4	25.9	*	3		0040	293	0.	.3	25.5
1		1530	94	0.	.7	28.8	*	2		0810	194	0.	.3	25.9	*	3		0050	294	0.	.3	25.5
1		1540	95	0.	.7	28.8	*	2		0820	195	0.	.3	25.9	*	3		0100	295	0.	.3	25.5
1		1550	96	0.	.7	28.7	*	2		0830	196	0.	.3	25.9	*	3		0110	296	0.	.3	25.5
1		1600	97	0.	.7	28.7	*	2		0840	197	0.	.3	25.8	*	3		0120	297	0.	.3	25.5
1		1610	98	0.	.7	28.7	*	2		0850	198	0.	.3	25.8	*	3		0130	298	0.	.3	25.5
1		1620	99	0.	.7	28.6	*	2		0900	199	0.	.3	25.8	*	3		0140	299	0.	.3	25.5
1		1630	100	0.	.7	28.6	*	2		0910	200	0.	.3	25.8	*	3		0150	300	0.	.3	25.5
							*								*							

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	49.83-HR
+ (CFS)	(HR)	(CFS)				
+ 1.	.17		1.	0.	0.	0.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	0.	1.	1.	1.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	49.83-HR
+ (AC-FT)	(HR)				
1.	.17	1.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	49.83-HR
+ (FEET)	(HR)				

32.90	.00	32.14	29.79	27.73	27.73

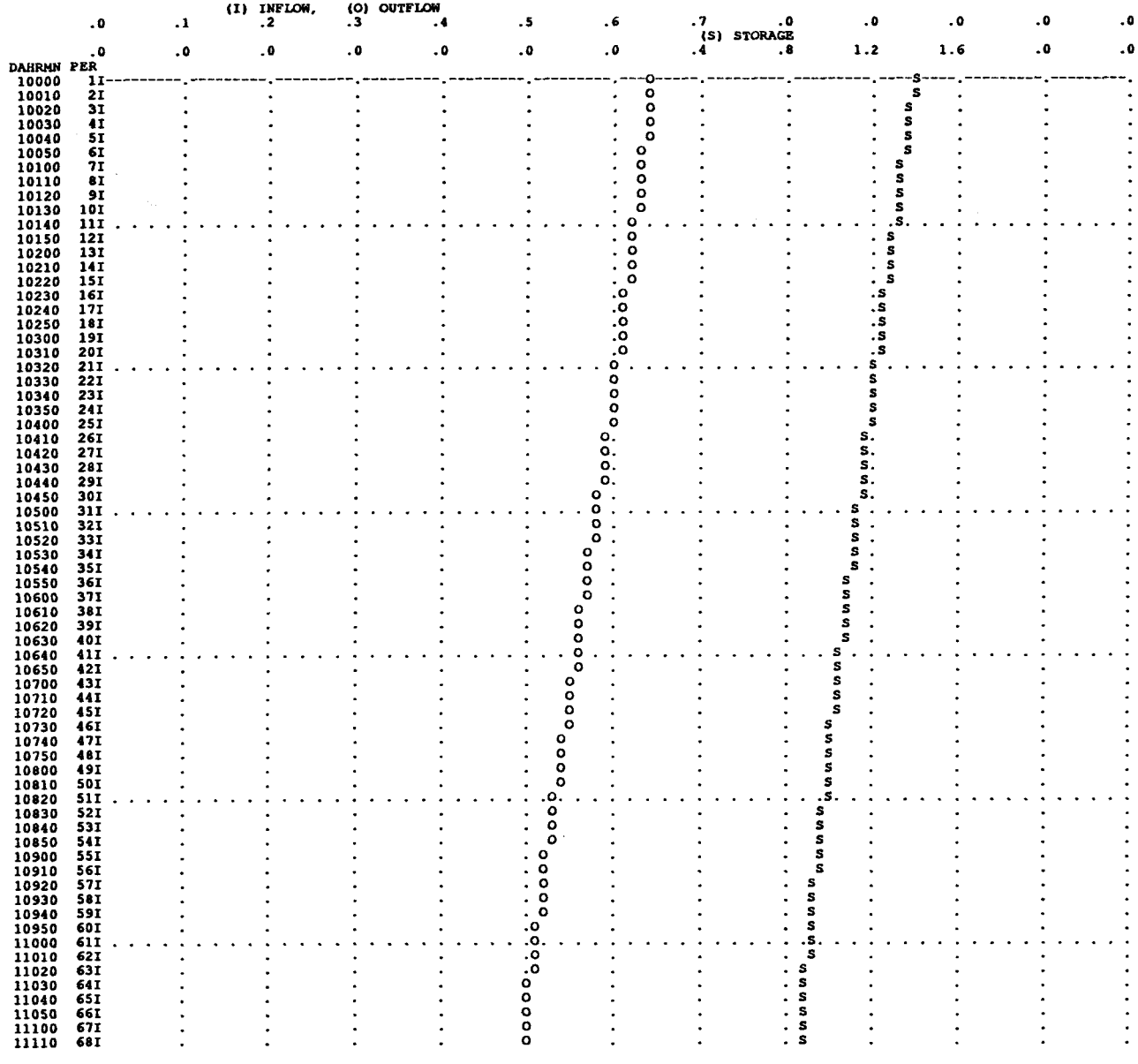
CUMULATIVE AREA = .00 SQ MI

1

STATION POND

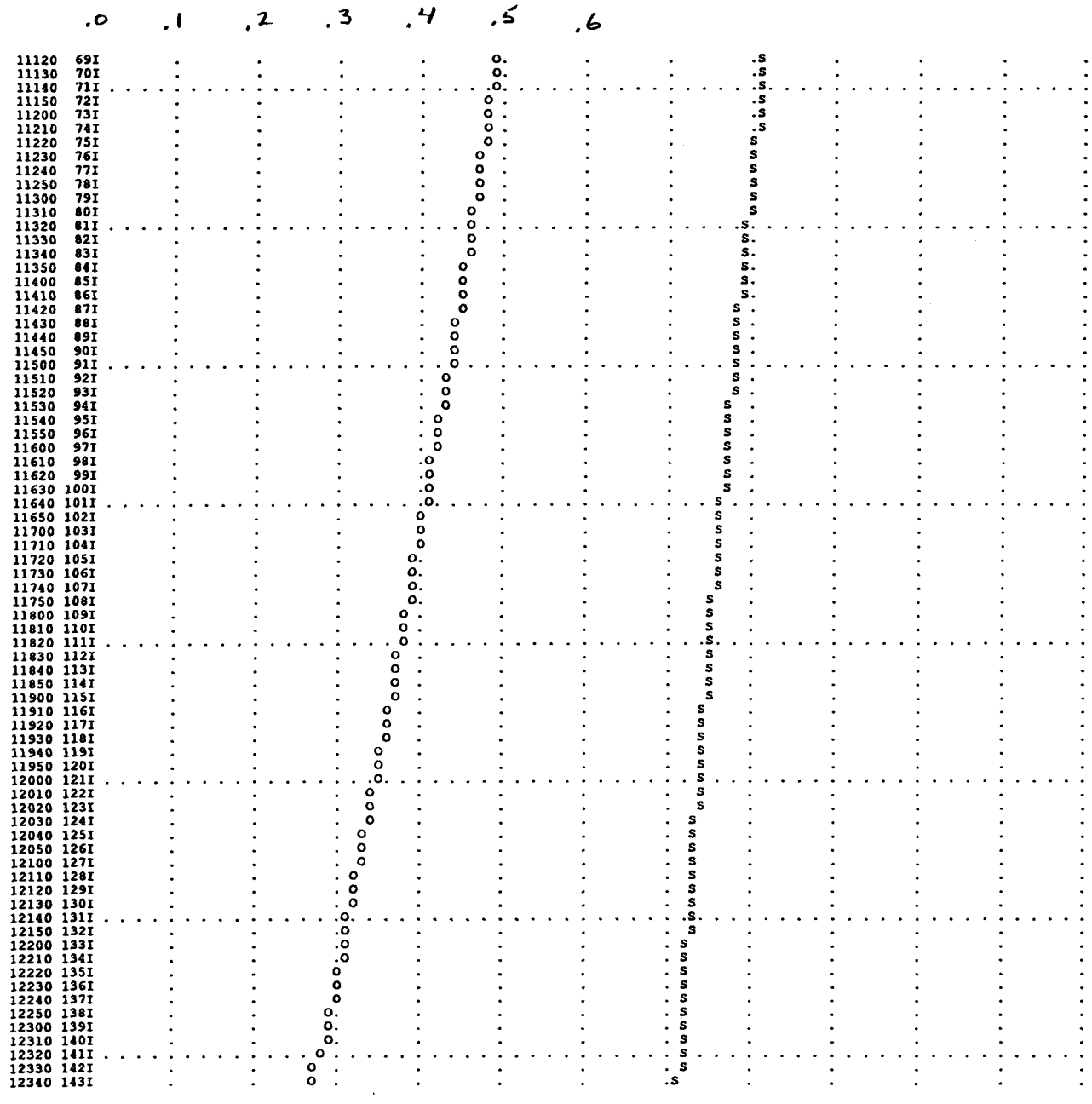
(I) INFLOW, (O) OUTFLOW

(S) STORAGE

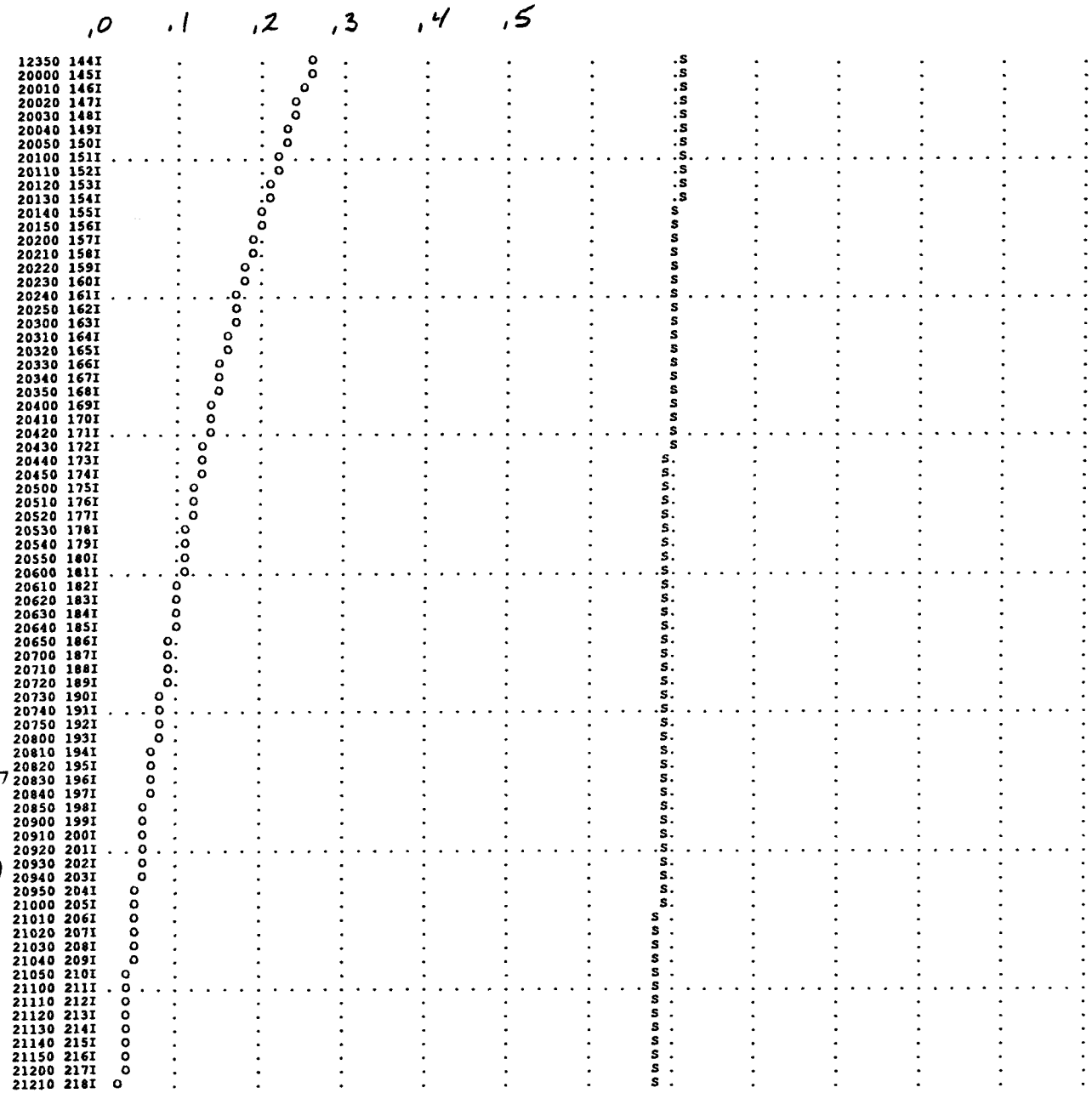


NOTE: ADD 50 hours to find elapsed time from beginning of storm

NOTE: ADD 50 hours to find elapsed time from beginning of storm



NOTE: ADD 50 HOURS to find elapsed time from beginning of storm



NOTE: ADD 50 HOURS TO FIND ELAPSED TIME FROM BEGINNING OF STORM

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                 .0    .1
21220 219I  O                                S
21230 220I  O                                S
21240 221I .O. . . . . . . . . . . . . . . . S . . . . . . . . . . . .
21250 222I  O                                S
21300 223I  O                                S
21310 224I  O                                S
21320 225I  O                                S
21330 226I  O                                S
21340 227I  O                                S
21350 228I  O                                S
21400 229I O                                 S
21410 230I O                                 S
21420 231I O . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
21430 232I O                                 S
21440 233I O                                 S
21450 234I O                                 S
21500 235I O                                 S
21510 236I O                                 S
21520 237I O                                 S
21530 238I O                                 S
21540 239I O                                 S
21550 240I O                                 S
21600 241I O . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
21610 242I O                                 S
21620 243I O                                 S
21630 244I O                                 S
21640 245IO                                  S
21650 246IO                                  S
21700 247IO                                  S
21710 248IO                                  S
21720 249IO                                  S
21730 250IO                                  S
21740 251IO. . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
21750 252IO                                  S
21800 253IO                                  S
21810 254IO                                  S
21820 255IO                                  S
21830 256IO                                  S
21840 257IO                                  S
21850 258IO                                  S
21900 259IO                                  S
21910 260IO                                  S
21920 261IO. . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
21930 262IO                                  S
21940 263IO                                  S
21950 264IO                                  S
22000 265IO                                  S
22010 266IO                                  S
22020 267IO                                  S
22030 268IO                                  S
22040 269IO                                  S
22050 270IO                                  S
22100 271IO. . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
22110 272IO                                  S
22120 273IO                                  S
22130 274IO                                  S
22140 275IO                                  S
22150 276IO                                  S
22200 277IO                                  S
22210 278IO                                  S
22220 279IO                                  S
22230 280I                                   S
22240 281I . . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
22250 282I                                   S
22300 283I                                   S
22310 284I                                   S
22320 285I                                   S
22330 286I                                   S
22340 287I                                   S
22350 288I                                   S
30000 289I                                   S
30010 290I                                   S
30020 291I . . . . . . . . . . . . . . . . . S . . . . . . . . . . . .
30030 292I                                   S
30040 293I                                   S
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30050 294I        .         .         .         .         .         .         S .         .         .         .         .         .
30100 295I        .         .         .         .         .         .         S .         .         .         .         .         .
30110 296I        .         .         .         .         .         .         S .         .         .         .         .         .
30120 297I        .         .         .         .         .         .         S .         .         .         .         .         .
30130 298I        .         .         .         .         .         .         S .         .         .         .         .         .
30140 299I        .         .         .         .         .         .         S .         .         .         .         .         .
30150 300I---------.---------.---------.---------.---------.---------.---------S-.---------.---------.---------.---------.---------.
1
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1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	DUMMYIN	0.	50.17	0.	0.	0.	.00		
+	ROUTED TO	POND	1.	50.17	1.	0.	0.	.00	32.90	50.00
+										

*** NORMAL END OF HEC-1 ***

South Pond Emergency Spillway
Riprap Design Calculations

HANSON ALLEN & LUCE inc

CLIENT UP&L
PROJECT Cottonwood / Wilberg Mine
FEATURE Rip-Rap Design for Spillway Channel
PROJECT NO.

SHEET ___ OF ___
COMPUTED JMH
CHECKED
DATE

REFERENCES USED:

Applied Hydrology and Sedimentology for Disturbed Areas; Barfield, B.J.; Warner, R.C.; Haan, C.T.; 1981 Oklahoma Technical Press, Stillwater, Oklahoma.

Urban Storm Drainage, Criteria Manual, Volume 2; Wright-McLaughlin Engineers; Denver, Colorado; March 1969.

HANSEN ALLEN & LUCE inc

CLIENT UP&L
PROJECT Cottonwood Wilbur Mine
FEATURE RIP-RAP DESIGN FOR SPILLWAY CHANNEL
PROJECT NO.

SHEET 1 OF
COMPUTED JAH
CHECKED
DATE 9/4/91

DESIGN FOR SAFETY FACTOR OF 1.5 (FOR CHANNEL BOTTOM)

TRY $D_{50} = 0.5'$

$n = 0.0395(0.5)^{1/6}$ $\quad d = 0.55'$ $\quad SG = 2.65$

$= 0.0352$ $\quad S = 2.31\%$

Check for Stability

$\tau = \gamma d s$

$= (62.4)(0.55)(0.0231)$

$= 0.7928 \text{ lbs/ft}^2$

$$\eta_b = \frac{21\tau}{\gamma(SG-1)D_{50}}$$

$$= \frac{21(0.7928)}{(62.4)(2.65-1)(0.5)} = 0.3234$$

ASSUME Rounded & ANGULAR RIP-RAP

$\phi = 41°$

$\theta = 1.32°$

Check Factor of Safety

$$SF_b = \frac{\cos\theta \tan\phi}{\sin\theta + \eta_b \tan\phi}$$

$$= \frac{(\cos 1.32)(\tan 41)}{\sin 1.32 + (0.3234)(\tan 41)}$$

$= 2.86 > 2.0 > 1$ O.K.

TRY $D_{50} = 0.25'$

$n = 0.0314$ $\quad \phi = 40°$

$d = 0.52$ $\quad \theta = 1.32°$

$\tau = 0.7495 \text{ lbs/ft}^2$ $\quad \eta_b = 0.6115$

$$SF_b = \frac{(\cos 1.32)(\tan 40)}{\sin 1.32 + .6115 \tan 40}$$

$= 1.56 > 1$ O.K.

USE $D_{50} \geq 0.25'$

RIP-RAP FOR CHANNEL SIDE SLOPES

$D_{50} = 0.5$ $\quad S = 2.31\%$
$n = 0.0352$ $\quad S.G. = 2.65$
$d = 0.55$ $\quad \phi = 41°$

DETERMINE τ_{max} - AND CHECK STABILITY

Assume $\tau_{max} = \gamma d s$

$= (62.4)(0.55)(0.0231)$
$= \underline{0.7928 \text{ lbs/ft}^2}$

$$\eta = \frac{21(\tau_{max})}{\gamma(SG-1)D_{50}}$$

$$= \frac{21(0.7928)}{(62.4)(2.65-1)(0.50)} = \underline{0.3234}$$

Assume Uniform flow $\lambda = \theta = 1.32$

$\alpha = 1/3 = \underline{18.4°}$

$$\beta = \tan^{-1}\left[\frac{\cos\lambda}{\frac{2\sin\alpha}{\eta\tan\phi} + \sin\lambda}\right] = \tan^{-1}\left[\frac{\cos 1.32}{\frac{2\sin 18.4}{(0.3234)\tan 41} + \sin 1.32}\right] = \underline{23.74°}$$

$$\eta' = \eta\left[\frac{1+\sin(\lambda+\beta)}{2}\right] = 0.3234\left[\frac{1+\sin(18.4+23.74)}{2}\right] = \underline{0.2703}$$

$$SF = \frac{\cos\alpha\tan\phi}{\eta'\tan\phi + \sin\alpha\cos\beta} = \frac{(\cos 18.4)(\tan 41)}{0.2703(\tan 41) + (\sin 18.4)(\cos 23.74)}$$

$SF = 1.57 <> 1$ O.K. $\qquad$ USE $\underline{\underline{D_{50} = 0.5'}}$

TRY $D_{50} = 1.25$

$n = 0.041$ $\quad \tau_{max} = 0.7928 \text{ lbs/ft}^2$ $\quad \eta = 0.1294$ $\quad \alpha = 18.4°$
$d = 0.60$ $\quad \phi = 42°$

$\beta = 10.39$ $\quad \eta' = 0.0778$

$SF = 2.24 > 1$ O.K.

UNDERLYING FILTER

Based on the Denver Design Method a 4 inch layer of Type I and a 4" layer of Type II can be used for the underlying filter. or a thicker single layer of Type II material may be used. Use a 9" thick layer of Type II.

Gradation for Type II

Sieve Size	% Passing by Weight
3"	90-100
1½"	–
¾"	20-90
⅜"	–
#4	0-20
#16	–
#50	–
#100	–
#200	0-3

Gradation for D_{50} = 0.5' Rip Rap

Type	% Smaller Than given Size by Weight	Intermediate Rock Dimension (In)
VL	70-100	12
	50-70	9
	35-50	6
	2-10	2

Anti-Seep Collar Design Calculations

HANSEN ALLEN & LUCE inc

CLIENT [illegible]
PROJECT [illegible]
FEATURE Anti-Seep Collar Design
PROJECT NO.

SHEET 1 OF [illegible]
COMPUTED [illegible]
CHECKED
DATE 9/11/91

REFERENCE USED:

Erosion and Sediment Control, Surface Mining in the Eastern U.S., Design; EPA Technology Transfer Seminar Publication; Volume 2, October 1976.

Anti-Seep Collar Design

$L_s + 2nV \geq 1.1 L_s$ or $n \geq \frac{0.05 L_s}{V}$

n - number of Collars
V - Vertical Protection of Collar (ft.)
L_s - Saturated length (ft.) of pipe.

$L_s = 79'$ use 80' Pipe usually in 18' or 20' sections one collar per section of pipe.

Maximum Spacing between collars $\geq 14V = 18'$

$18 = 14V$ $V = 1.29' \approx 1.33'$. Use 1'-4"

$n \geq \frac{0.05 L_s}{V}$

$\geq \frac{0.05(80)}{1.33}$

$n \geq 3.$ Use 4 collars

$80 + 2(4)(1.33) \geq 1.1(80)$
$90.63 \geq 88$ O.K.

Use 4 collars Spaced @ 18'

Collar size: 5'-8" x 5'-8"